Assessment of an Expert System for Space Life Sciences: a Preliminary Ground-Based Evaluation of PI-in-a-Box for the Neurolab Sleep and Respiration Experiment

by

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ABSTRACT

Principal Investigator-in-a-Box (abbreviated [PI]) is an expert system designed to assist astronauts with the performance of an experiment outside their field of expertise when contact with the Principal Investigators on the ground is not allowed or impossible. The latest version of [PI] was designed to assist with the calibration and troubleshooting procedures of the Neurolab Sleep and Respiration Experiment, launched on the Space Shuttle Columbia on April 17, 1998. The role of [PI] in this application is to display physiological signals in real time during the pre-sleep instrumentation period, and to alert the astronauts when a poor signal quality (due to incorrect application of the instrumentation or a hardware malfunction) is detected.

As the first expert system ever designed to be an integral part of a Space Life Sciences experiment, a formal and structured evaluation of the efficacy of such a system is unprecedented. The study presented in this thesis is a preliminary assessment of the efficacy of [PI] with the "poor signal quality detection" process. The twelve subjects used for this study were required to monitor a set of pre-recorded physiological signals and identify signal artifacts displayed on the screen. Every subject performed the experiment twice, once with the assistance of [PI] and once without, in a balanced design. Results indicated a positive effect of [PI] on overall time to detect anomalies. The combination of previous exposure to signal monitoring (training) and [PI] assistance was a significant factor in the improvement of overall reaction time. Also, the assistance of the expert system dramatically reduced the number of undetected anomalies.

Having been designed for a life sciences experiment, the evaluation of [PI] was modeled after that of ground-based medical information systems. As for most medical expert systems, evaluation is an iterative process, and this study represents the first step, providing many insights and recommendations for more in-depth studies in the future, as well as exploring possible ramifications and expansions of the uses of expert systems in space.

Thesis Supervisor: Laurence R. Young
Title: Apollo Program Professor of Astronautics

Acknowledgments

Who said that writing the acknowledgments to a thesis was going to be easy? This page (or two) went through more rewrites than I care to admit... I keep thinking that in 1992 I was just a clueless high school boy who didn't even speak English, and almost six year later I am writing the acknowledgments to my Master's thesis, shortly after returning from the Johnson Space Center for the Neurolab Mission. I've come a long way, and I know I could not have done this alone...not without all those people who made me laugh and cry, who made me happy and sad...not without those people who made me feel alive.

Professor Young...where do I start? Thank you so much for giving me the opportunity to work on a project that *flew,* and will fly again, in space. This is major bragging material. I still can't forget meeting you on the gym floor during Orientation as I was shamelessly stuffing myself with a chicken sandwich while you were asking me what my plans for the future were: I hope the first impression didn't count! I am proud to have been able to write my own chapter of the [PI] saga.

Dennis, you deserve most of the credit: after all if it weren't for you there would be no [PI] for me to work with! Thanks for babysitting me in Houston. I'm hungry, can we go get something to eat? Big thanks to the whole Sleep Team who made the SMA seem anything but boring. Eymard, you need some sleep (no pun intended). Karen, sorry I didn't see you in Texas, but running the pilot study with you was fun...thanks for teaching me how to play "Hydrodot" on Derk-Jan's ceiling! Are they still up there?

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I'll make sure no one picks your pocket (hanging out with a native is a whole different experience).

Tom, thanks for all the good memories from senior year...in the meantime, I'll be waiting for you to embrace the arcane world of email...actually even that obscure device called telephone would work, you know...

Kevin, thanks for making this summer in Boston absolutely awesome: after all, I needed someone to discuss the X-Files and Ally McBeall with. Thanks for trying to teach me that pressure is good and stress is bad: I think it sort of worked. I can't wait to read your book! Best of luck in Ohio and wherever else life will take you.

Chiara! Was this fast enough? 2 years in 1, 4 years in 3, 5 years in 4 etc. we're setting too many precedents here. What's next? I can't wait to read a newspaper with your name on it...and no, I know you won't end up in a hair salon, please...Are we still on for that date on the moon? Good luck in London!

Caroline and Thelma, your prayers helped. We'll go see a Spice Girls concert someday (before they all split up). Ollie, thanks for thinking (at one point) that I, an EYEtalian, was the cutest :) (ego boost!!). Thanks for the many chats and, let's not forget, the Tasty Kakes!!! Just move up to Boston and we'll have fun. Thanks to Rena, Alessandra, Anna, Nancy, Meredith and Georges for not letting distance be an issue in keeping our friendships alive. Thank God for email!!

Nancy and Traci, Joe and Judy, Piero and Mariella, Dr. and Mrs. Gregory, Mr. and Mrs. Piskadlo: thanks for being my homes away from home. Thanks for the hospitality, the warmth, and the home cooked meals! Just knowing you were there made a lot of difference.

Thanks (bold, italic, and underlined) to Tilly and Luciano, a.k.a. "mom and dad" (or *mamma e papa'*). Thanks for the support and for believeing I could do this. Thanks for letting me go. Thanks for being proud...thanks for...well thanks for being my parents (no easy task). I could not have been more fortunate. Thanks to my aunt Laura and uncle Marcello for their support: you are the best! Thanks to my grandmother "nonna Chicca" for her love and encouragement, and thanks to Dr. Adelfio Caruso, the greatest man, artist, engineer and grandfather I have ever met...I hope you can see this: Nonno Feffio, this is for you.

This research was funded by the NSBRI PI-in-a-Box grant and NASA Ames Research Center, grant number NCC 2-570.

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A l'alta fantasia qui manco' possa;
Ma gia' volgeva il mio disio e 'l velle,
Si come rota ch'igualmente e' mossa

L'amor che move il sole e l'altre stelle.

(Here power failed the lofty fantasy;
but already my desire and my will were revolved,
like a wheel that is evenly moved,
by the Love which moves the sun and the other stars).

Dante, Paradiso XXXIII: 142-145

Chapter 1

Introduction

1.1 Expert Systems

Expert Systems are computer programs derived from a branch of computer science research called *Artificial Intelligence* (AI)[1]. These programs are designed to help solving problems in various areas by providing the user with a body of knowledge necessary to accomplish a specific task. For the past two decades, expert systems have been implemented in various fields such as medicine, finance, banking, telecommunication, air traffic control and even government applications.

The applications of expert systems are quite diverse making it almost impossible to classify them. However, they tend to cluster in seven major classes:[2]

1. Diagnosis and Troubleshooting of Devices and Systems of all kinds;
2. Planning and Scheduling;
3. Configuration of Manufactured Objects from Subassemblies;
4. Financial Decision Making;
5. Knowledge Publishing;
6. Process Monitoring and Control (real time);
7. Design and Manufacturing.

Expert systems can also be designed to encompass more than one of these areas at once. Real-time expert systems are of special interest since they analyze real-time data

[1] Engelmore and Feigenbaum
[2] Ibid

from a system with the intent of noticing anomalies and reporting them to the user, as well as predicting trends and controlling for optimality and failure correction[3].

Artificial intelligence programs such as these have the potential to serve as powerful tools when performing experiments in space. During the course of a single mission, astronauts usually conduct several experiments outside their field of expertise while the Principal Investigators are on the ground. Errors in the experimental procedure can cause poor data collection or even complete data loss, possibly resulting in loss of money and effort.

Many other factors influence astronaut performance, such as fatigue, delay between training and the actual performance of the experiment, and possible stress accumulated during long-duration space flights. Inhibition on the use of air-to-ground communication except for the case of an unforeseen failure in the setup of an experiment is another element, since the astronauts are instructed not to contact the Mission Control Center unless absolutely necessary. In light of the increasing number of long-duration space flights, such as on the International Space Station, these problems are bound to increase. For this reason, expert systems might help reduce the likelihood of making errors by aiding the astronauts when the Principal Investigator on the ground cannot be contacted.

Although real-time expert systems have been successfully used in space before, a systematic study to quantitatively assess their efficacy in aiding a user with the performance of an experiment has never been conducted. The focus of this study is to assess the efficacy of this technique using the latest real-time expert system developed for the STS-90 Neurolab Space Shuttle mission, called Principal Investigator-in-a-Box

[3] Engelmore and Feigenbaum

(abbreviated PI-in-a-Box or [PI]), which aided the astronauts with the troubleshooting and calibration procedures of one of the Neurolab Experiments.

1.2 Objective

Using [PI] for the Neurolab Sleep Experiment, this study will attempt to quantify the efficacy of an expert system in assisting with the troubleshooting and calibration of an apparatus by conducting an experiment with "astronaut surrogates." While a more detailed ground-based study will be conducted in the upcoming months, the results presented here will provide valuable information on the use of the expert system and the adequate training required, as well as recommendations for future studies, versions and uses of [PI] on other Space Shuttle and Space Station missions.

1.3 Methods

Expert systems, even if mostly not real-time, are fairly popular in the medical field. [PI] was developed to aid astronauts with a life sciences experiment, making medical diagnostics its *task domain* ("task" being the expert system's problem solving activity and "domain" the area within which the task is performed)[4]. There is extensive literature available on the evaluation of medical expert systems and AI applications, and while the evaluation of a real-time medical expert system in this manner is unprecedented, most of the same methods apply.

Evaluation of a clinical/medical system, like any system, takes place over several iterative steps during the development cycle. In fact, the evaluation continues even after

[4] Engelmore and Feigenbaum

the system has been disseminated. The current status of [PI] and the role of this study within the development process are indicated in the diagram below.

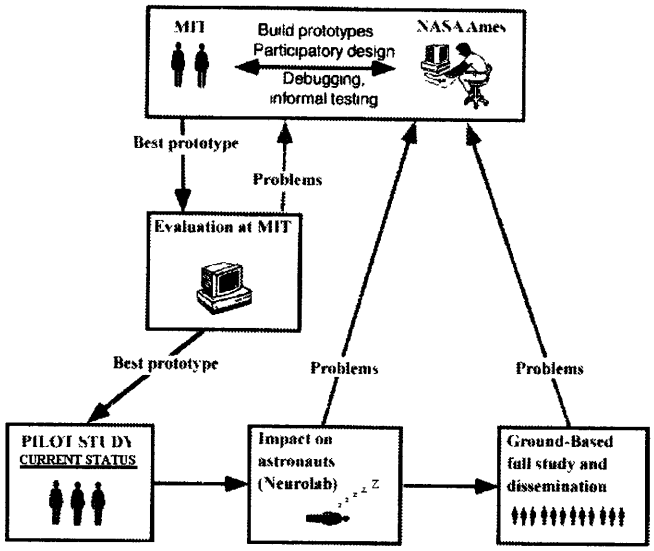

Figure 1.1: The Evaluation Process of a System and [PI] Status[5]

[5] Adapted from Friedman and Wyatt

Chapter 2

Background

2.1 Categorization of Expert Systems

Expert systems fall into that category of human-computer interaction called "supervisory control" which, in a broad sense, is defined as the continuous exchange of information between one or more users and a computer which interconnects to the process task or the environment through various artificial means (sensor, effectors etc.)[1]. In order to achieve the goal they have been designed for, expert systems employ knowledge of techniques, information, heuristics (rules of thumb), and problem solving processes that human experts use to solve such problems[2].

Most expert systems mimic this level of human behavior (defined as *rule-based*) to recognize patterns and activate their algorithms to execute the appropriate response[3]. The most popular method employed to encode such algorithms is by expressing the knowledge with a series of "if-then" rules: when the data being fed to the software matches the "if" part of a statement, the corresponding action (contained in the "then" part of the statement) is activated.

2.2 Principal Investigator-in-a-Box

The concept for Principal Investigator-in-a-Box was created by Professor Laurence Young in 1987 in collaboration with NASA Ames Research Center. Since

[1] Sheridan
[2] Prerau

having every Principal Investigator fly into space with his or her experiment would be highly impractical, the goal was to create a system containing the knowledge of a Principal Investigator and allow it to accompany the experiment in space[4]. The first version of [PI], formally known as the Astronaut Science Advisor (ASA), was used to assist the astronauts in the performance of the "Rotating Dome" visual-vestibular interaction experiment on the SLS-2 mission in 1993. This first version of [PI] provided data collection capabilities, as well as protocol assistance, scheduling, and protocol modifications suggestions. An additional feature consisted of an "interesting data" filter, designed to perform quick-look data analysis and report any data anomalies. The experiment was successful, and the system proved to be robust and helped the astronauts in maintaining good data quality; its troubleshooting capabilities, however, were not used, due to lack of astronaut training and, consequently, confidence in the system[5].

2.3 Current Version of [PI]

Due to the successful implementation of the ASA with the Rotating Dome experiment, MIT and NASA Ames research center collaborated on the development of a new version of [PI] in conjunction with Dr. Czeisler's "Sleep, Respiration and Melatonin in Microgravity" experiment which was launched on the Neurolab mission in April 1998. Differently from the ASA, however, this new version of [PI] was designed as an integral and vital part of the experiment. The flight version of this latest incarnation of [PI] was submitted to the Johnson Space Center at the beginning of 1998. [PI] has been designed to assist the astronauts with the calibration and troubleshooting of the instrumentation

[3] Rasmussen
[4] Smith

during the pre-sleep period of the experiment; its role is to display the physiological signals during the instrumentation calibration, identify anomalous signals and suggest corrective procedures when necessary[6]. [PI] is invaluable during this section of this experiment, since during the pre-sleep and instrumentation period, contact with the Principal Investigators on the ground does not normally occur. While most of the coding of [PI] was done at NASA Ames, the malfunction procedures were developed at MIT using a fault tree approach[7].

The Sleep experiment will be repeated on the STS-95 mission to study the effects of space flight on sleep and aging, using Senator John Glenn as one of the subjects. The mission is scheduled to fly in October 1998. For this mission, [PI] will be updated and improved, also based on observations made from the results of this study.

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[5] Young
[6] Smith
[7] Ibid

Chapter 3

Experimental Hardware and Software Overview

3.1 Overview of the Neurolab Sleep Experiment

3.1.1 Motivation for the Sleep Experiment

The experiment performed for this thesis was conceived to evaluate [PI] objectively, and is not to be confused with the Sleep Experiment, even though the expert system was in fact developed for it. Due to the nature of this version of [PI], The study presented here is based on an experiment that contains elements of the Sleep Experiment, but it does not actually replicate it or replace it. The Neurolab Sleep Experiment was created to investigate the factors contributing to sleep disorders on long-duration space flights. During missions in space, the quality of astronauts' sleep is poor[1] due to several reasons.

A very important factor is the absence of gravity. On Earth, humans constantly use their muscles to fight the force of gravity exerted on the human body. Even the simple act of standing up requires the muscles to work against gravity. In space the force of gravity is absent, therefore the astronaut do not have to exert their muscles to support their weight. As a result, muscle exertion in space is considerably less than on Earth, which may result in poor sleep quality.

Another factor is the irregularity of a "day" in space. As the space shuttle orbits the Earth, the orbit's period is of about 90 minutes. Therefore, since the sun rises and sets approximately every hour and a half, it is impossible for the astronauts to rely on the sun to determine when it is time to sleep. The crew operates on Houston time (CDT) and the

sleep schedule is shifted by a couple of hours every night due to a gradual time shift[2]. This and the crew roster affect the normal sleep schedules and circadian rhythms of the astronauts, resulting in poor sleep quality.

The sleep experiment was designed as a collaborative effort between Brigham and Women's Hospital (Harvard Medical School) and The University of California, San Diego. By administering melatonin or a placebo to the subjects, Dr. Charles Czeisler of BWH, the Principal Investigator, will attempt to study and regulate the sleeping patterns and therefore improve cognitive performance of the astronauts. Dr. John West of UCSD, the other Principal Investigator, will be studying the effects of zero-g on the cardiorespiratory system as a possible cause for poor sleep quality.

The sleep experiment was performed on eight days divided into two four-day sessions. The first session was performed from flight day 3 to 6 and the second from flight day12 to 15. Subjects were paired in groups of two, and only two subjects performed the experiment at any given time. A data downlink was performed every morning following a sleep session to allow the Principal Investigators on the ground to examine the data collected.

The experiment designed for the study discussed in this thesis simulates in part the Neurolab Sleep experiment, but does not require most of the instrumentation that was used during the mission. In order to understand [PI]'s role and the experiment in general, however, a brief description of the Sleep Experiment hardware is provided.

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[1] Santy et al.
[2] Smith

The experimental setup consists of the sleep and respiration hardware, a digital sleep recorder and a laptop computer on which [PI] was installed. A diagram of the hardware configuration (during the pre-sleep calibration mode) is shown in Figure 3.1.

Figure 3.1: Pre-Sleep Hardware Configuration

3.1.2 The E-Net

The Hydrodot NeuroMonitoring System, referred to as E-Net, was worn by the subjects during the sleep sessions to record their EEG, EMG and EOG signals. The E-Net is a web-like elastic cap with 13 housings for disposable biosensors (hydrodots), and a cable with a 50-pin multiconnector which allows it to be connected to the digital sleep recorder. The E-net allows the subjects to place the hydrodots in approximately the same sites, minimizing the possibility of errors in recording due to electrode misplacement. The hydrodots are small sensors filled with a sticky, water-soluble gel which adheres to the skin and provides better contact than regular electrodes. While the E-net may feel uncomfortable, this problem was not present in space (or was at least reduced) since the astronauts' head was not resting on any surface during sleep.

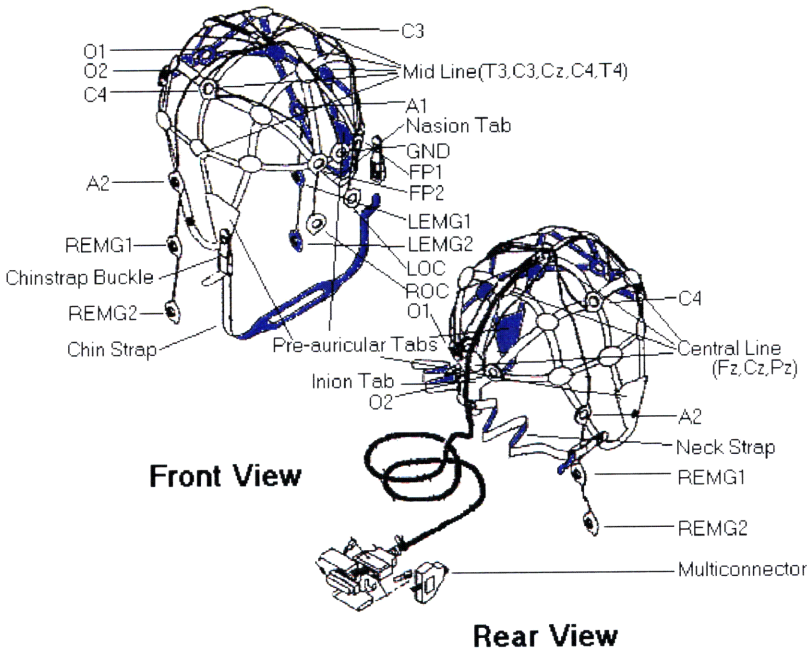

Figure 3.2: E-Net Diagram[3]

3.1.3 The RIP Suit

In order to measure the cardiorespiratory sleeping patterns, the astronauts wore a "Respiratory Inductance Plethysmography" (RIP) suit to measure the extension and relaxation of the rib cage and abdomen. The RIP suit is basically a lycra body-suit with two coils embedded at the chest and abdomen levels of the subject's body. The cardiorespiratory apparatus also consists of a nasal thermistor, a microphone to measure snoring, EKG leads to measure heart rate, and a pulse oximeter on the finger to measure the oxygen level in the blood. The wiring for all these components is grouped into a large cable called the "Borg Harness" which also has a 50-pin multiconnector to interface with the digital sleep recorder.

3.1.4 The Digital Sleep Recorder

The signals coming from the E-Net and the RIP suit are recorded by a unit called the digital sleep recorder (DSR). The DSR selected for this experiment was the Vitaport2 recording system, shown on Figure 3.3.

Figure 3.3: Digital Sleep Recorder[4]

The DSR interfaces with the E-Net and RIP suit through the 50-pin multiconnectors. The unit operates with four AA batteries and records the signal on an 85 MB FlashRAM PCMCIA data card. The data from the card can be downloaded the morning following the sleep session.

3.2 Experimental Hardware

Even though [PI] was developed on a Pentium-based laptop computer, the flight hardware consists of an IBM ThinkPad 755C with a 486 75 MHz processor and 20 MB of RAM. The 486 processor is the latest chip that has been certified and approved by

[3] Diagram Provided by Eymard Riel, Center for Circadian Medicine, Brigham and Women's Hospital, Boston, MA

NASA for space flight: no Pentium computers have flown on the Space Shuttle to this date. Throughout the development of [PI], it was always kept in mind that the final product would be running on a computer equipped with a slower processor than the one it was developed on. The ThinkPad is connected to the DSR using an optical RS-232 cable during the pre-sleep calibration period. The DSR sends sleep and respiration signals to the laptop through the serial port. [PI] displays the signals and analyzes the data. At this stage of the experiment, the astronauts are required to go through a series of calibration procedures to insure that the instrumentation was properly applied (see Appendix A).

The experiment performed for the study presented in this thesis only required a laptop computer and [PI] playing a set of pre-recorded sleep signals. For the study, faster computers were used than the flight ones, but this change in computer configuration did not affect [PI]'s performance at all. The experimental hardware consisted of six IBM ThinkPad laptops 385CD equipped with a Pentium 150 MHz with MMX processor, and 32 MB of RAM.

3.3 Software: [PI]

The code for [PI] was written in C++ and the reasoning engine was coded using the "C Language Integrated Production System" (CLIPS)[5] expert system language. The version of [PI] used for the study, version 3.00, is the same version used for the Neurolab Sleep Experiment. The graphic user interface consists of two separate screens. One displays the cardiorespiratory (CR) signals, and the other the electrophysiological (EP)

[4] Diagram Provided by Eymard Riel, Center for Circadian Medicine, Brigham and Women's Hospital, Boston, MA

[5] Copyright 1989, Artificial Intelligence Section of the Mission Planning and Analysis Division, NASA-JSC, Houston, TX

signals. Both screens display the incoming signals (from the DSR) in real time, and it is possible to toggle between the two screens by clicking on the "buttons" at the top of the screen. The cardiorespiratory and electrophysiological screens are shown on Figure 3.4.

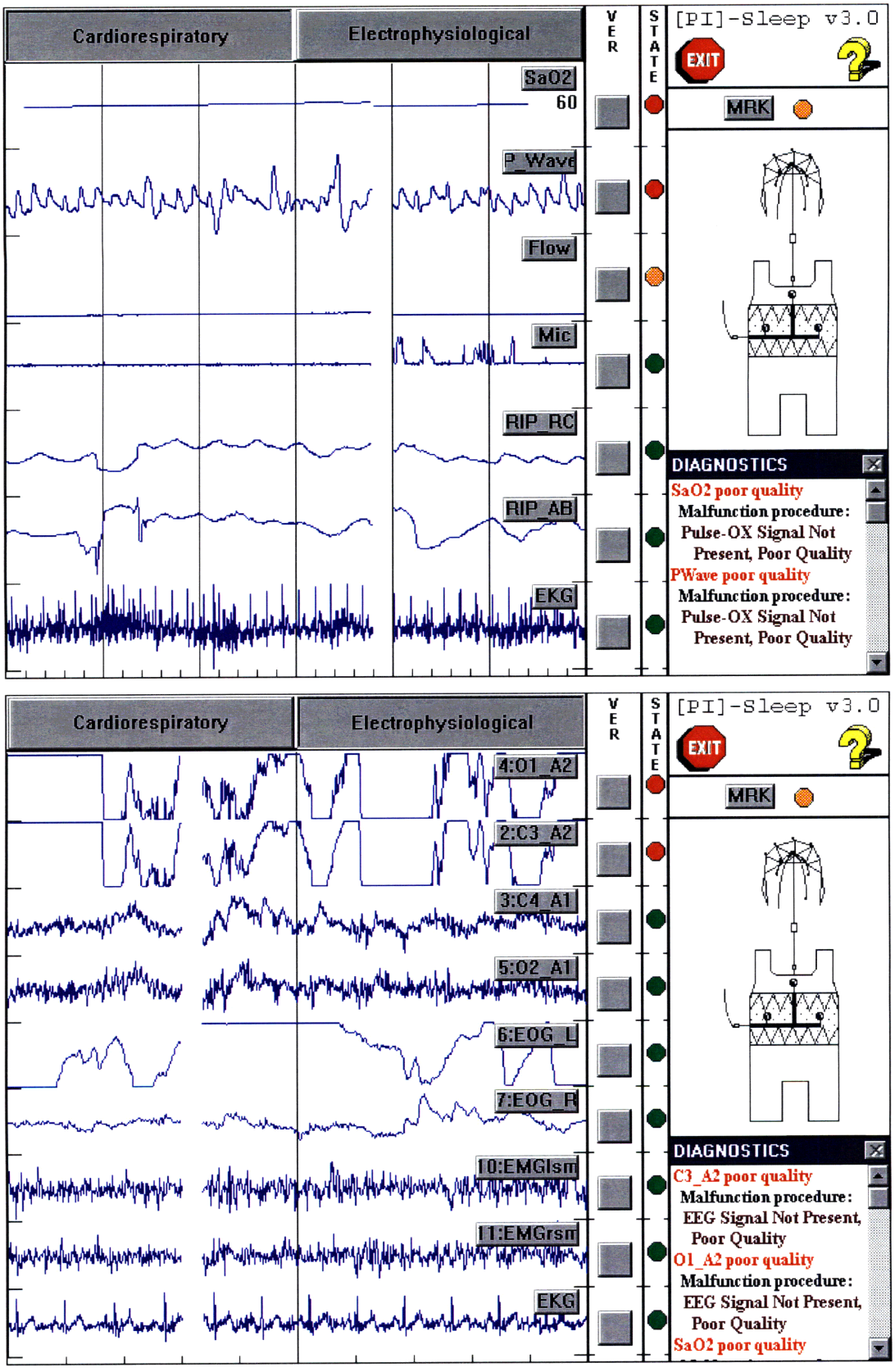

Figure 3.4: [PI] Graphic User Interface: CR and EP Displays[6]

[6] Bitmap images provided by Dennis M. Heher, Caelum Research Corporation, Moffett Field, CA

Each vertical line represents five seconds of data. As shown in the previous pictures, a LED next to each signal indicates its quality: green for good quality, red for poor quality and amber for unknown or marginal quality. In case of a bad quality signal, [PI] will flash a red light next to the appropriate trace and a message will appear in the diagnostic box on the lower right-hand corner instructing the user to follow the malfunction procedure displayed. The diagnostic box can also be set to simply alert the user of a malfunction and to refer him or her to a malfunction procedure manual supplied with the Neurolab equipment (see Appendix B). In order to play back the data acquired during the pre-sleep section of the Sleep Experiment, [PI] was equipped with the capability to replay pre-recorded data files. This feature was used for the study. When the "response" feature is on, clicking on one of the checkboxes next to the various signals will also record the clock and data file time of the mouse click and will open a pop-up message box where text can be entered or some options can be chosen (as will be explained later). [PI] can record these mouse-click times (response times), as well as the onset of bad quality signals, in a text file. Another important feature of [PI] version 3.00 is the selective reasoning option, which allows the user to decide which signals [PI] is going to display warning lights and diagnostic messages for.

Chapter 4

Signal Overview and [PI] Logic

4.1 Signals Displayed by [PI]

During the sleep experiment, nine different kinds of signals are recorded and displayed by [PI] on the two windows presented in the previous chapter. The cardiorespiratory signals (for UCSD's respiration experiment) include rib cage and abdomen extension, airflow, microphone, level of SaO_2 in the blood and electrocardiogram (EKG). The electrophysiological signals displayed are the electroencephalogram (EEG), electro-oculogram (EOG) and electromyogram (EMG). Multiple traces are displayed for some of these signals, and the EKG is displayed in both the CR and EP windows. The total number of traces displayed by [PI] in each window is reported in the table below:

Table 4.1: Signals Displayed by [PI]

Electrophysiological Window	Cardiorespiratory Window
EEG (4 traces)	SaO2
EOG (2 traces)	Airflow
EMG (2 traces)	PWave
EKG	EKG
	RIP – abdomen
	RIP – rib cage
	Microphone

The experiment run for this study only involved the monitoring of the signals displayed on the electrophysiological window, therefore a brief overview of these signals will be provided.

4.2 Normal Signals

4.2.1 Electroencephalogram (EEG)

The electroencephalogram is the underlying brain wave and it is the most important signal in the evaluation of sleep data. In sleep studies, at least a central and an occipital EEG are recorded. However two of each are recorded in the Sleep Experiment for redundancy[1]. When the subject is awake with eyes open, the EEG looks like a wide-band, low amplitude (10-200 μV) signal. When the subject's eyes are closed, a higher frequency signal (in the 8-12 Hz range) appears, known as alpha wave. A greater amount of alpha activity is therefore observed during sleep. Figure 4.1 shows a typical good quality EEG signal, including the characteristic alpha activity.

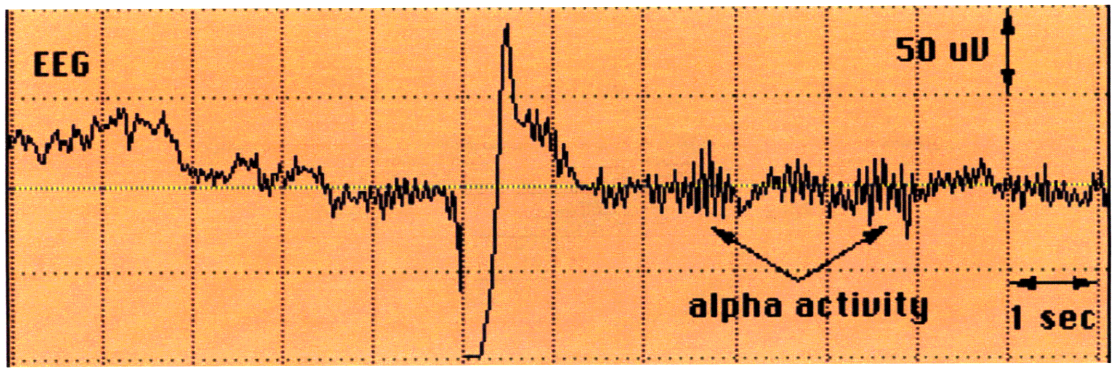

Figure 4.1: Typical Good Quality EEG signal

[1] Smith

4.2.2 Electro-oculogram (EOG)

The electro-oculogram consists of two distinct traces, one per eye. The EOG signals are extremely important for the determination of REM sleep, since any kind of eye movement is highly distinguishable on the EOG signals due to their shape.

The EOG signals make use of the potential difference that exists across each eyeball: the cornea (located in the front of the eye) is in fact positively charged with respect to the retina (located in the back of the eye).

Each EOG electrode is referenced to the electrode located behind the opposite ear. Because of this, any eye movement across the horizontal plane produces a negative voltage in one eye and a positive voltage in the other; the deflection that these movements produce on the EOG signals are approximately equal in magnitude but opposite in polarity[2]: an eye movement to the right results in a negative (upward) deviation of the left EOG signal and a positive (downward) deviation of the right EOG signal. The exact opposite situation occurs for an eye movement to the left. Depending on the magnitude of the eye movement, EOG deflections can present an amplitude range from 20 to 500 μV. Visual examples of these eye movements are shown on Figure 4.2.

[2] Smith

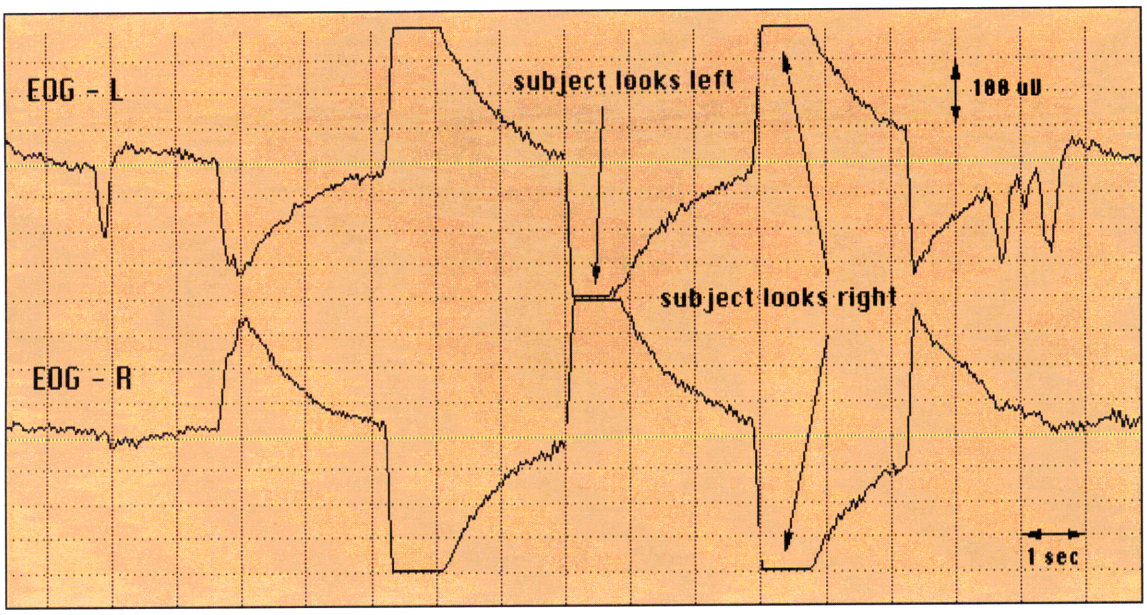

Figure 4.2: Typical Good Quality Left/Right EOG Signals

Because of the electrode placement (right EOG above the eye and left EOG below), and the polarity in each eyeball, up and down eye movements also produce deflections in the EOG signals that are similar to left and right eye movement patterns, but smaller in magnitude. An upward eye movement creates a negative (upward) deflection of the left EOG trace and a positive (downward) deflection on the right EOG signal. The reverse happens for downward eye movements. It is interesting to note that the magnitude of up/down movements on the right eye is generally more noticeable than the left eye because of the electrode placement: the right EOG electrode, placed above the right eye, also picks up movements of the upper lid. Examples of upward and downward eye movements are shown on Figure 4.3.

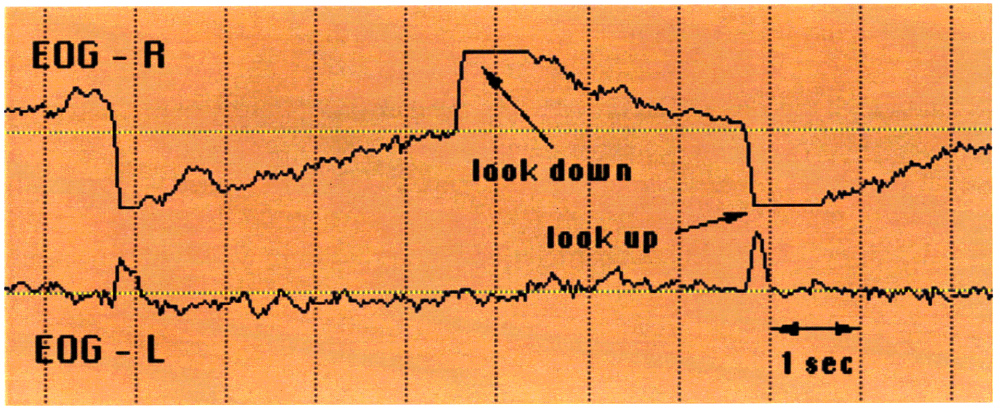

Figure 4.3: Typical Good Quality Up/Down EOG Signals

4.2.3 Electromyogram (EMG)

The last electrophysiological signal recorded with the E-Net is the electromyogram, which indicates muscle activity under the chin. The EMG also helps distinguish REM state, since one of the characteristics of REM sleep is also the loss of muscle tone[3]. Generally, the EMG looks like a noisy, high frequency signal which dramatically increases in frequency and amplitude in case of a muscle contraction (clenched jaw). The amplitude can vary generally within a range from 20 to 300 μV. An example of a typical EMG signal is show in Figure 4.4.

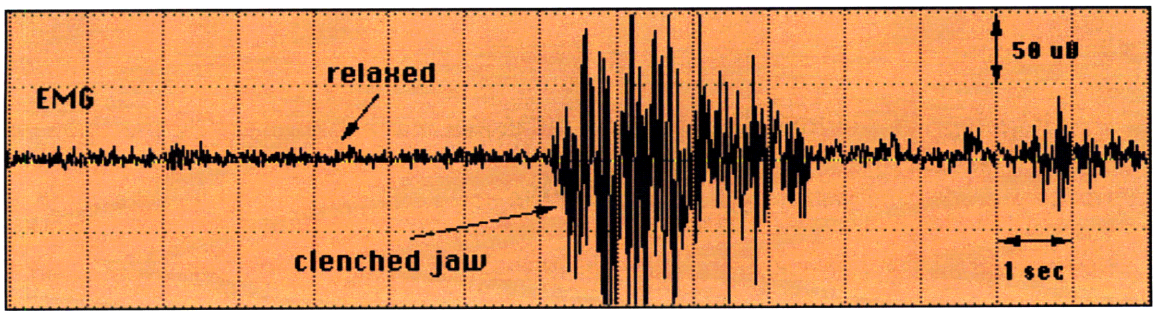

Figure 4.4: Typical Good Quality EMG Signal

[3] Smith

4.2.4 Electrocardiogram (EKG)

Even though the EKG is recorded using the cardiorespiratory instrumentation, it is displayed on the electrophysiological window, and was therefore used with the other EP signals for the study. The EKG is characterized by a rhythmic wave pattern (referred to as QRS).

4.3 Signal Artifacts

4.3.1 Classes of Anomalies

Due to several possible faults in the instrumentation setup or hardware, signal deterioration can occur. On the [PI] display, the signal artifacts are shown on the screen, and the corresponding red light accompanied by a diagnostic message calls the operator' s attention to that particular signal. While the causes for a signal artifact can be attributed to many different sources, their visual appearance was grouped in three major categories. This categorization was also used in the experiment. The three classes of possible signal anomalies are presented in the following sections.

4.3.2 Popping

"Popping" is a term used to refer to the signal anomaly created by the poor or intermittent contact between an electrode and the scalp. Popping is probably the most distinctive and easiest anomaly to recognize. Since it is created by the poor application of an electrode, popping can appear in any of the electrophysiological signals. An example of popping (on an EEG signal) is shown in Figure 4.5.

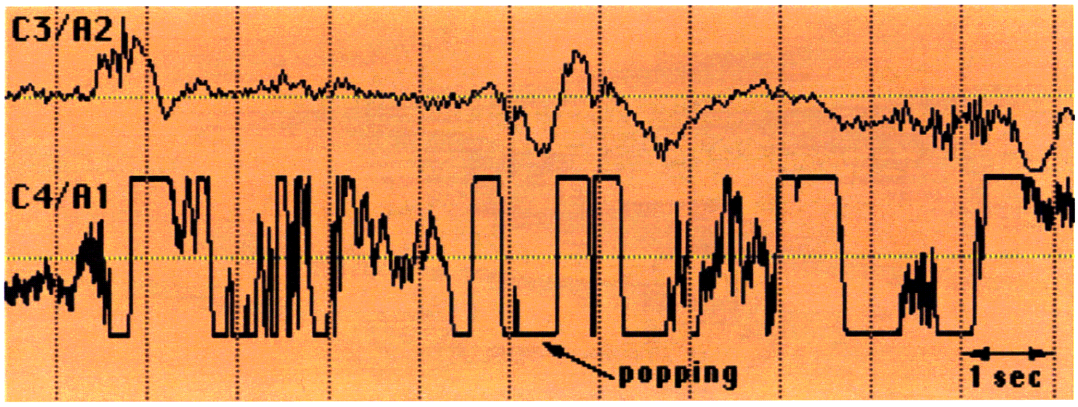

Figure 4.5: Popping Anomaly on an EEG Signal

4.3.3 Noise

Another common type of anomaly is noise introduced into a signal. Noise is usually manifested as a random, high frequency (around 60 Hz) pattern, and it can be introduced in a variety of ways. The most common cause is probably the incorrect placement of an electrode; other causes, such as sudden or excessive head movements, can also create a noisy signal. Insufficient scrubbing of a site, therefore resulting in high impedance, can also create noise. Figure 4.6 shows a noisy EOG signal compared to a good quality signal. Because of the inherently "noisy" appearance of the electrophysiological signals, noise is sometimes hard to detect, especially in the EMG.

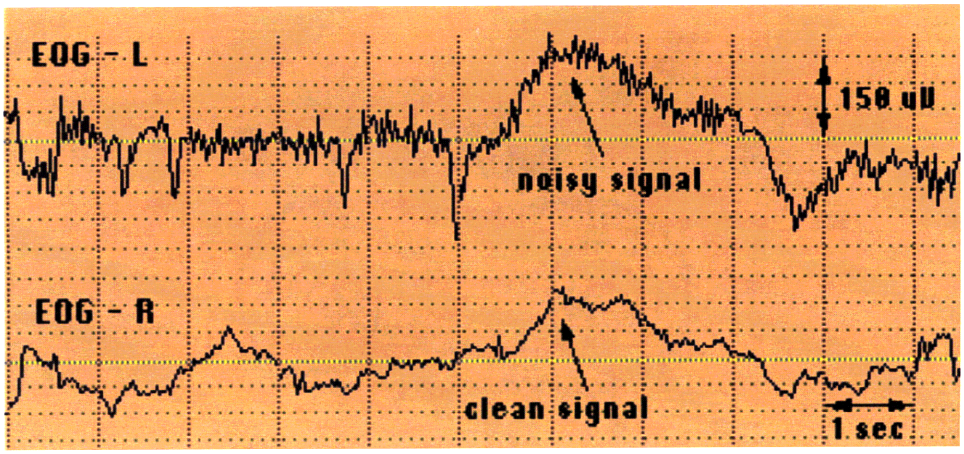

Figure 4.6: Noisy EOG Signal Compared to a Clean EOG Signal

4.3.4 Flat Signal

The third major category of signal anomalies is a flat signal. As can be expected, a flat signal is displayed when an electrode is completely detached from the skin. Flat signals are probably the easiest type of anomalies to detect, but can sometimes be confused with simple saturation. Figure 4.7 shows a typical flat signal in an EMG.

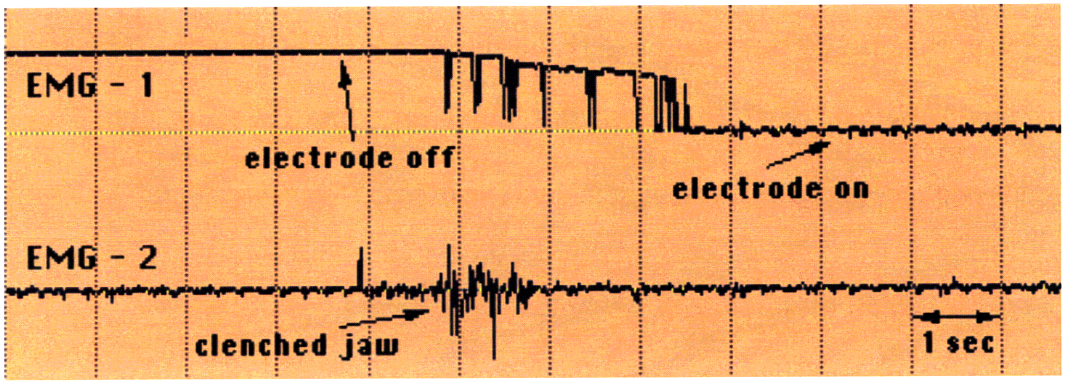

Figure 4.7: Flat EMG Signal

4.4 [PI] Logic for Signal Presence and Quality

During the pre-sleep calibration period, as it records the signals coming from the instrumentation, the DSR also sends them to the ThinkPad through the RS-232 optically isolated serial cable. The signals are received by [PI] and bytes and must be converted in meaningful and analyzable units such as μV. The data is then stored in a 4-second buffer, and the buffer is analyzed every second. [PI] performs several kinds of statistical analyses (average and standard deviations, mean and variance). For the EKG and PWave, the beats per second (bps) are also measured. [PI] and the DSR communicate at 19200 baud, even though the DSR is set at 9600 baud by default. The DSR sends 32 bytes of data at 40.0 Hz to the ThinkPad. The data breakdown and the converted measurement ranges are shown in the table below.

Table 4.2: Signal Reception Breakdown and Measurement Ranges[4]

SIGNAL	Amount of Data (bytes)	Converted Units	Range
EEG (C3, O1, C4, O2)	8	μV	± 200.0
EOG (left, right)	4	μV	± 400.0
EMG (left, right)	4	μV	± 100.0
EKG	2	mV	± 2.0
SaO_2	2	%	0.0 to 100.0
PWave	2	%	± 100.0
RIP (abdominal, rib cage)	4	%	± 100.0
Airflow	2	%	± 100.0
Event Marker	1	%	0.0 to 100.0
Microphone	2	on/off	0.0 to 100.0
Synchronization	1	-	-
TOTAL	32	-	-

[4] All the [PI] reasoning and following rules, as well as the CLIPS coding, were provided by Dennis M. Heher, Caelum Research Corporation, Moffett Field, CA

The statistical information calculated by [PI] is then transferred to the expert system reasoning engine to check for signal presence. When activated for the first time, [PI] waits 20 second before analyzing the signals for presence and then performs this check every second. The criteria used by the reasoning engine for signal presence are tabulated in Table 4.3; note that the units for these statistical quantities (both on the table below and the following one) are related to the units presented in Table 4.2 for each individual signal.

Table 4.3: Criteria used by [PI] for Signal Presence

SIGNAL	Present if	Converted Units
EEG (C3, O1, C4, O2)	variance >= 20.0	μV
EOG (left, right)	variance >= 20.0	μV
EMG (left, right)	variance >= 5.0	μV
EKG	standard dev. >= 0.10	mV
SaO_2	mV value >= 1.0	%
PWave	standard dev. >= 15.00	%
RIP (abdominal, rib cage)	variance >= 1	%
Airflow	variance >= 5.0	%
Event Marker	Signal is on*	%
Microphone	Signal is on*	On/off

* For the event marker and the microphone there is no way to check for signal presence until a signal is on

Once the [PI] rules have established the presence of a signal, the signal quality is then analyzed with a different set of rules. As before, the rules change from signal to signal. For every signals, [PI] has rules for good (green light), poor (red light) and marginal/unknown (amber light) quality signal. When a poor signal is detected, the malfunction procedures are shown on the diagnostic box. The signal quality rules are shown in Table 4.4.

Table 4.4: [PI] Signal Quality Rules

SIGNAL	STATUS	RULES
EEG (μV)	*Good*	100 <variance< 4000
	Unknown	4000 <variance< 7500
	Poor	variance > 7500
EOG (μV)	*Good*	variance > 30 AND -100 <mean< 100
	Unknown	variance < 30 AND -100 <mean< 100
	Poor	mean > 100 OR mean < -100
EMG (μV)	*Unknown*	Currently no Diagnostics
EKG (mV)	*Good*	1 <bps< 1.8
	Unknown	0.75 <bps< 1.0 OR 1.8 <bps< 2.5
	Poor	bps < 0.75 OR bps > 2.5
SaO_2 (%)	*Good*	value > 95%
	Poor	value < 95%
PWave (%)	*Good*	1 <bps< 1.8
	Unknown	0.75 <bps< 1.0 OR 1.8 <bps< 2.5
	Poor	bps < 0.75 OR bps > 2.5
RIP (%)	*Good*	ave-dev > 1.0
	Poor	ave-dev < 1.0
Airflow (%)	*Good*	5 <ave-dev< 60
	Unknown	0.5 <ave-dev< 5
	Poor	ave-dev < 0.5 OR ave-dev > 60
Mic (on/off)	*Good*	ave-dev > 0.5
	Unknown	ave-dev < 0.5

Note that [PI] does not perform any diagnostics for the EMG signals, since its "noisy" nature makes it extremely difficult to quantitatively assess its quality. The only rules available for the EMG are those for signal presence. When a poor signal becomes stable, [PI] waits for 5 seconds before the changing the status light to green and removing the diagnostic message. A complete listing of the [PI] rules, coded in CLIPS, is presented in Appendix C. Note that [PI] does not make any distinctions as to whether the signals are coming directly from the DSR or from a pre-recorded data file.

Chapter 5

Experiment

5.1 Overview

The experiment whose results will be analyzed in this thesis was run as part of a pilot study throughout the month of January 1998. The pilot study was performed to acquire preliminary results on the efficacy of [PI] to submit to the National Space Biomedical Research Institute: on the basis of these findings, a full NSBRI grant for further [PI] studies was awarded to Professor Laurence Young in April 1998. This pilot study was divided in two phases which were very distinct and had different goals. The second phase of the experiment, conducted with a *decision facilitation approach*[1], was geared to the evaluation of this particular version of [PI] (for the Sleep Experiment), in an attempt to pinpoint its weaknesses and areas that needed improvement before the Neurolab Mission. While the findings from this phase are of no particular relevance to this thesis, they were nonetheless interesting: a brief description and discussion of this phase of the pilot study (as written and submitted to Dr. Derk-Jan Dijk of Brigham and Women's Hospital) is presented in Appendix D.

The first phase of the pilot study, which will be the focus of this thesis, was conducted using live subjects to test the hypothesis that an expert system such as [PI] would successfully assist users with the performance of a life sciences experiment relatively out of their field of expertise. The experiment was conducted following a

[1] Friedman and Wyatt

comparison-based approach[2], since the results were compared to a control condition, with training but no computer decision aid. The goal was also to pinpoint the effects that improved subject's performance during the experiment.

5.2 Subjects

A total of twelve subjects, six male and six female, took part in this experiment. The subjects were all graduate students in the Department of Aeronautics and Astronautics at MIT. Informed consent was obtained from each subject prior to the beginning of the experiment sessions. A sample of the informed consent form is reported in Appendix E. The mean age of the subjects is 25 years; only one subject was older than 30 years.

During the first meeting, the subjects were also asked to complete a questionnaire to establish the uniformity of the subject pool: the questionnaire revealed that none of the subjects had ever been previously exposed to sleep signal monitoring experiments, and that they were all right handed. Subject 5 was partly colorblind but he did not specify to what extent, or if this condition would impair his capability to conduct the experiment. A copy of the questionnaire is also provided in Appendix E.

5.3 Training and Experimental Protocol

5.3.1 Training

The day before the beginning of the experiment, the subjects attended an hour and a half long training lecture. The training introduced the subjects to the identification of electrophysiological sleep data, including the detection of signal anomalies created by

[2] Friedman and Wyatt

improper instrumentation setup or hardware malfunction. An abbreviated version of the material covered in the Signal Overview chapter was presented. The subjects were also introduced to [PI] and its diagnostic capabilities. A live demonstration was given to the subjects by having [PI] play a data file. The experiment was fully described and a short quiz was administered at the end of the session to assess the adequacy of the level of training of the subjects, who mostly received perfect scores. A copy of the quiz is shown in Appendix F.

5.3.2 Experimental Protocol

The subjects were divided into two groups of six and asked to monitor a set of pre-recorded electrophysiological signals and detect and identify each signal artifact displayed on the screen. Due to scheduling and subjects' time constraints, the groups were not balanced by gender. The first group (group A) was composed of four males and two females and the second group (group B) by four females and two males. Acting as his or her own control group, every subject performed the experiment with and without the help of [PI]'s diagnostic capabilities on two consecutive days. The groups performed the tests in a crossover fashion as represented below:

Table 5.1: Experimental Test Matrix

	Day 1	**Day 2**
Group A	[PI] Diagnostics ON	[PI] Diagnostics OFF
Group B	[PI] Diagnostics OFF	[PI] Diagnostics ON

The subjects were provided with a reference manual containing a synopsis of the training session, as well as a list of the anomalies displayed by [PI] (see Appendix F). After briefly reviewing the material covered in the training session, the subjects were

instructed to start. The duration of every test session was about twenty minutes. All the twelve subjects completed the experiment and no software or hardware failures were experienced.

5.4 Data File

The data file the subjects were asked to monitor was recorded at the Johnson Space Center during one of Neurolab crew member Richard Linnehan's training sessions. The data file contains a total of 59 anomalies for the electrophysiological signals (4 EEG, 2 EOG) and the EKG. The subjects were instructed to ignore the EMG, since [PI] does not perform signal quality diagnostics and it would have been impossible to calculate any kind of response time without knowing the onset time. Also, since the subjects were asked to monitor only the signals displayed on the electrophysiological window, the reasoning for the cardiorespiratory signals was deactivated to prevent [PI] from displaying warning messages about the CP signals in the diagnostic box, which could have distracted or confused the subjects. Because it was a real, therefore not artificially assembled, data file, the order of the anomalies is at random and it consists mostly of popping anomalies (47) mixed with nine flat signals and five noisy signals. At least one anomaly appears on every signal displayed. The same file was used for all the tests on both days, but, due to the duration and random order of the artifacts presented, there were no indications that the subjects acquired enough familiarity with the file to influence their performances on the second experimental day. In order to compare the results obtained by the subjects, the data file was played on [PI] without intervention from a user, therefore the output response file simply contained a series of 59 anomaly onset times.

The file was then replayed to visually inspect the nature of the 59 reported signal artifacts in order to assign each one of them to one of the three major signal artifact groups. This provided a sort of "answer key" to which the subject response files could be compared. This recorded list of events is shown in Appendix G.

Chapter 6

Data Collection and Analysis

6.1 Overview

For every test session, [PI] created a text file containing anomaly onset times and subject response times as well as subjects' anomaly identifications. With twelve subjects running the experiment twice, therefore, a total of 24 raw response files was recorded. In order to be analyzed, the data had to be re-arranged and sorted out in a variety of ways.

6.2 Raw Data Acquisition

Whenever detecting a signal artifact, [PI] recorded both the clock time and the data file playback time in the response file. Any [PI] detection was accompanied by the line:

[PI] <signal> poor quality.

Whenever a subject detected an anomaly (either by himself or herself, or with the help of [PI]'s warning lights) and clicked on the button next to the appropriate signal, [PI] recorded the mouse click time (both as clock time and data file playback time). The mouse click also froze the data play back and opened a message box presenting the subject with four choices for the signal diagnosis: "popping," "flat," "noise," or "other." The "other" option was followed by a small text box where the subject could type a particular diagnosis or comment. When an anomaly option was chosen, and the "ok" button on the message box clicked, [PI] resumed the data play back. On the response files, subject detection times appeared just as the [PI] detections explained above, with

the exception of the "[PI]" sign. The complete series of the 24 raw data files is shown in Appendix G.

6.3 Data Format and Manipulation

6.3.1 Data Extraction

Using a database and a routine based on Visual Basic for Applications[1], the onset and response times were extracted and inserted into a spreadsheet. The routine was programmed to search for an onset data file time (labeled by the [PI] sign) and then look for its corresponding subject response time. The time window allowed for every response time was five seconds before [PI] detection (since it was observed that subjects would sometimes detect the anomaly visually before [PI] completed its statistical analysis and flashed a red light) and twenty seconds after it. The value of twenty seconds was chosen because that is the time window displayed on the [PI] screen. After appearing, an anomaly would take twenty seconds to "travel" across the screen before disappearing (unless it continued on when the screen was completely refreshed). If the corresponding response was not found within the time window, that particular anomaly was considered to be "timed out" and a value of 30 seconds for the subject response time was assigned. The code for the routine, as well as documentation on the database, is presented in Appendix I.

[1] Developed by Kevin Seefried, KSeefried & Associates, Atlanta, GA

6.3.2 Data Manipulation and Analysis

After obtaining the complete set of data in the spreadsheet, the subject reaction time for every anomaly was calculated by subtracting the anomaly onset time from the subject response time. For example, for the i^{th} subject and the j^{th} anomaly, the reaction time was calculated as follows:

$$REACT_{ij} = (SUBJ\_RESP)_{ij} - ([PI]\ ONSET)_{ij} \quad (1)$$

After the reaction times were computed, the average reaction times for every subject for every trial were found. The routine also inserted the number of undetected (timed-out) anomalies in the spreadsheet.

The mean effects of day and [PI] help on the average reaction time were calculated in seconds as follows:

$$[PI]\ effect = AVE\_REACT_{no[PI]} - AVE\_REACT_{[PI]} \quad \text{for ever subject} \quad (2)$$

$$DAY\ effect = AVE\_REACT_{day\ 2} - AVE\_REACT_{day\ 1} \quad \text{for every subject} \quad (3)$$

A positive effect for a given condition indicates that the [PI] assistance or day effect decreased the reaction time (or the number of undetected anomalies)[2].

Every individual trial was labeled with the following variables: subject, group, gender, day, and [PI] help. Repeated measures analysis determined the significance of the effects and cross effects of these variables on reactions times, number of undetected

[2] Rochlis

anomalies and correct identifications. The results are presented in the following chapter, while the tabulated data used for the analysis is shown in Appendix H.

Chapter 7

Results and Discussion

7.1 Analyzed Effects

This chapter presents the results obtained for the data analysis defined in the previous chapter. Main and cross effects are reported and discussed for general reaction time, as well as for reaction times per anomaly type. The effects on the number of undetected anomalies are also studied. Before analyzing the reaction times for every subject, it was necessary to verify the absence of autocorrelation of the responses within the individual subjects: he analyses described below, in fact, required every response time to be completely independent and uninfluenced by the previous and following response (hence, the data points needed to be randomly distributed). Autocorrelation plots for every kind of anomaly for every subject, with or without the assistance of [PI], were studied, and the absence of autocorrelation was confirmed.

7.2 Reaction Times

The average reaction times for the subjects, divided into the two groups, were plotted to graphically observe the performance. These plots are shown in Figures 7.1 (a) and (b).

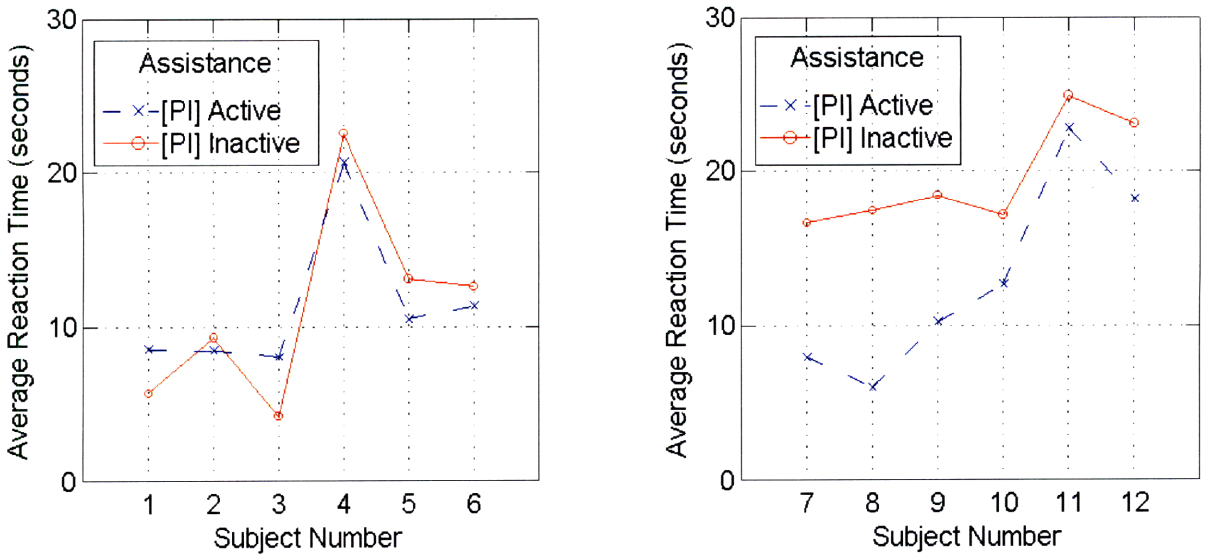

Figure 7.1 (a) and (b): Subject Overall Average Reaction Times for Groups A & B

Before proceeding to the repeated measures analysis, several observations can be inferred from the graphs about the average reaction time of the subjects. Members of group B performed the experiment *without* the assistance of [PI] on the first day and *with* the assistance of [PI] on the second day. Most of these subjects showed a significant improvement in response time the second day, when [PI] was activated, as seen in Figure 7.1 (b). The average response time for Group B almost decreased by half on day two with [PI] assistance. Group A, however, which received assistance from [PI] diagnostics on day one, did not show a significant difference in average response time on day two, when [PI] assistance was not given, as shown in Figure 7.1 (a). The average response time decreased only by a minimum amount on day two (without [PI] assistance).

The table below summarizes the statistical analysis for the average overall reaction time:

Table 7.1: Main and Cross Effects on Average Reaction Time

Effects	N[1]	T[2]	F[3]	p[4]	Mean Effect[5] (s)
DAY (D)	59	1.337	2.586	0.127	3.322
[PI] Assistance (PI)	59	1.327	2.157	0.161	3.299
PIxD	59	1.35	14.953	**0.001**	**10.062**

Statistically, the only effect on the average reaction time was the combination of [PI] assistance and day, suggesting that the subjects were able to detect signal anomalies about 10 second faster with [PI] on the second day, due to a positive influence of training. This would indicate a training effect on both the usage of [PI] and the monitoring of sleep signals. This is reflected in Figure 7.1 (b) where the subjects who used [PI] on the second day performed much better the other subjects.

In order to verify if the subjects performed in different ways with particular kinds of anomalies, the same sort of analysis was performed for each of the three anomaly types. The average reaction times for popping anomalies are shown in Figures 7.2 (a) and (b) on the next page.

[1] n is the number of cases used for every type of measure studied. The maximum number for this value is 59, since the data files recorded contained 59 anomalies.
[2] t is the pool variance obtained from the t-test and it indicates the significance of a given effect on a particular measurement.
[3] F is the F-ratio, which is the ratio of the mean square of each effect or cross-effect to the mean square for error.
[4]The p value is the probability of exceeding the F-ratio and indicates the significance of a given effect on a measurement. An effect is defined significant if the p value is less than 0.05.
[5] This is the mean value of the effects (see the previous chapter).

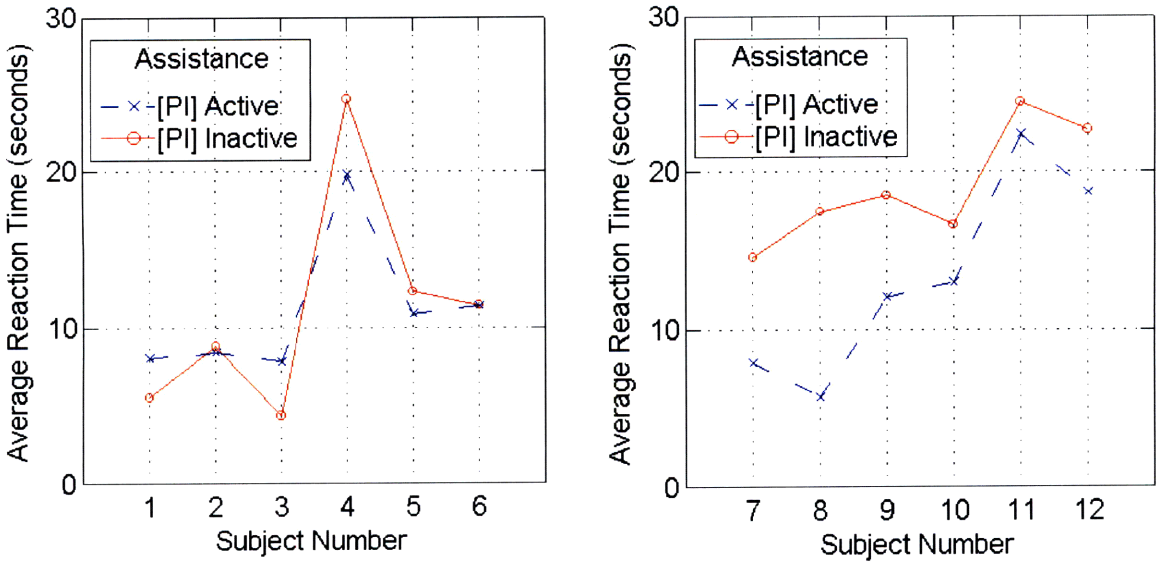

Figure 7.2 (a) and (b): Average Reaction Times for Popping Anomalies

As observed for the overall reaction time, group B performed better on the second day when the subject received help from [PI] suggesting the same kind of cross-effect of [PI] assistance and training observed before. This was confirmed by the repeated measures analysis:

Table 7.2: Effects on Average Reaction Time for Popping Anomalies

Effects	n	T	F	p	Mean Effect (s)
DAY (D)	45	1.117	1.692	0.212	2.822
[PI] Assistance (PI)	45	1.167	1.471	0.243	2.944
PIxD	45	1.329	13.29	**0.002**	**10.096**

As expected, the effect of day and [PI] help is greatly significant, causing the subject to react about 10 second faster. Note that the numerical values are similar to the overall reaction time. This is due to the fact that popping anomalies accounted for most of the signal artifacts present in the data file (about 76% of the total number of anomalies).

The second anomaly type analyzed was noise, whose results are charted below:

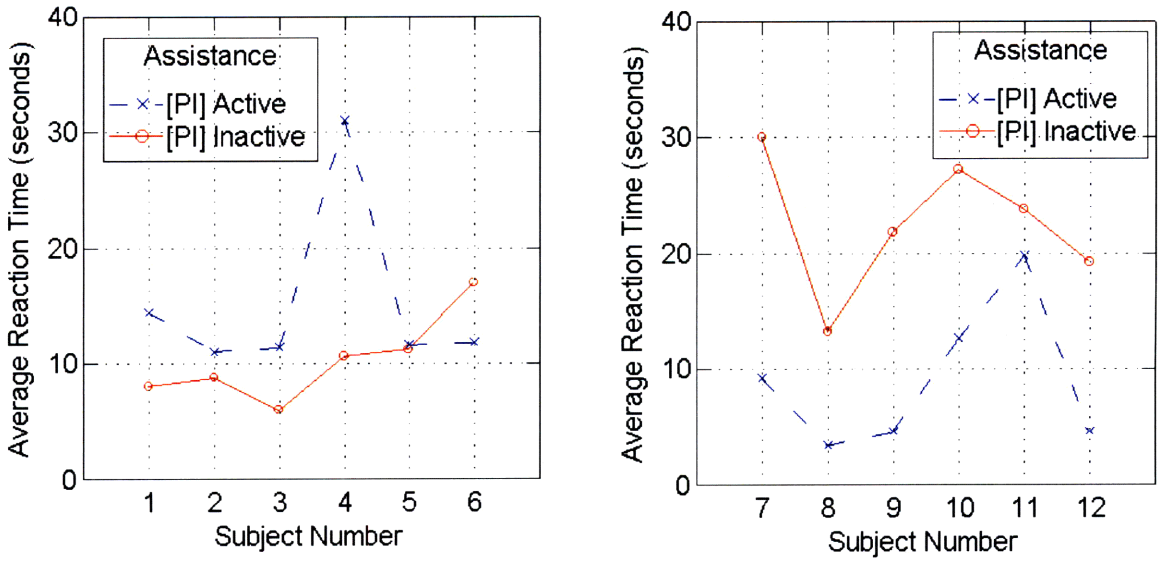

Figure 7.3 (a) and (b): Average Reaction Times for Noise Anomalies

While the subjects of group B still performed better than those of group A, the graphs show that both groups detected noise anomalies much faster on the second day, regardless of the [PI] assistance (in fact subject 4 in group A did not seem to benefit from [PI] on the first day at all). The statistical analysis shown in Table 7.3 confirms this observation by showing a significance of day only. This can be attributed to the very nature of the electrophysiological signals: the difficulty in monitoring these signals is in their appearance, whose oscillations may initially make it difficult to distinguish a good quality signal from an actual noise artifact. Previous exposure to these signals certainly helped improve detection of these signal artifacts.

Table 7.3: Effects on Average Reaction Time for Noise Anomalies

Effects	n	T	F	p	Mean Effect (s)
DAY (D)	5	3.487	9.123	**0.008**	**9.217**
[PI] Assistance (PI)	5	1.354	1.811	0.197	4.283
PixD	5	0.909	1.835	0.194	0.866

The results for the third anomaly type (flat signal) are shown in the figures below:

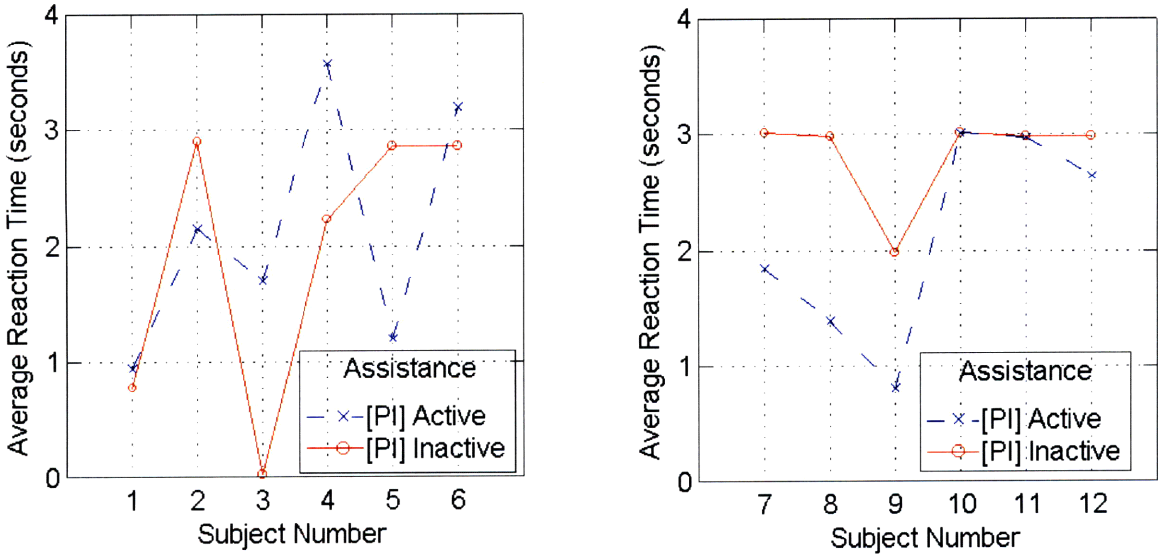

Figure 7.4 (a) and (b): Average Reaction Times for Flat Anomalies

Again, all subjects showed shorter reaction times on the second day, and the assistance of [PI] on the subjects in group B enhanced their performance on day two.

Table 7.4: Effects on Average Reaction Time for Flat Anomalies

Effects	n	T	F	p	Mean Effect (s)
DAY (D)	9	1.159	1.014	0.329	0.45
[PI] Assistance (PI)	9	0.67	3.591	0.076	0.265
PIxD	9	0.87	19.791	**0**	**6.1**

As expected from observing the graphs, Table 7.4 above confirms that there is a significant cross-effect from the combination of [PI] help and day, which caused the subject to react to flat anomalies about 6 seconds faster on the second day.

Note that in all the reaction times analyzed above, although the effect of [PI] assistance alone was not statistically significant, it still showed a trend that subject reacted faster when [PI] was helping them, definitely suggesting a positive influence on subject performance.

7.3 Subject Effects

Figure 7.5 below shows the subject variances for the overall reaction times. The variance for every subject was calculated using all 59 reaction times for every subject.

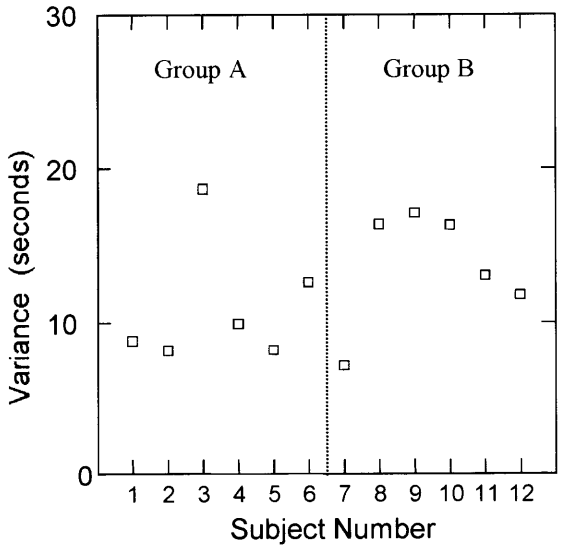

Figure 7.5: Subject Variance for Overall Reaction Time

The variances for all subjects appear fairly consistent, with the exception of subject 3 (unusually high for group A) and subject 7 (unusually low for group B). Note

that, in general, variances for subjects of group B (subjects 8 through 12) were higher than for those in group A. Reaction times for subject 3 are plotted below.

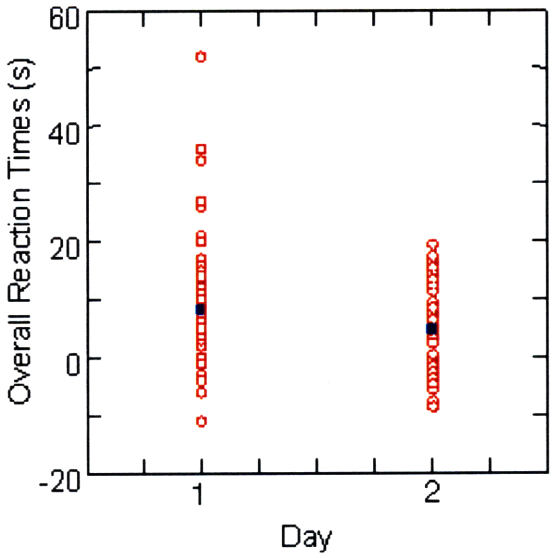

Figure 7.6 : Subject 3 Reaction Times per Day

As a member of group A, subject 3 performed the experiment on the first day with the assistance of [PI] and without it on the following day. The mean reaction time, indicated in the graphs by the dark square, was about four seconds lower on the second day, suggesting the training effect explained in the previous sections. By looking at the figures above, it can be observed that the reaction times are more consistent on the second day, suggesting a positive change in strategy from the first day, where the responses indicate the subject may not have had a clear grasp on the best approach to the signal monitoring process: the lower level of training and exposure to [PI] caused subject 3 to have several time outs and to respond more slowly on the first day: this caused the reaction times to be distributed over a range of more than 60 seconds (while other

subjects' responses are within smaller ranges), which may have resulted or contributed to the high variance.

Subject 7, however, presented a lower variance than the other members of group B. Figure 7.7 below shows the subject response times and means per day.

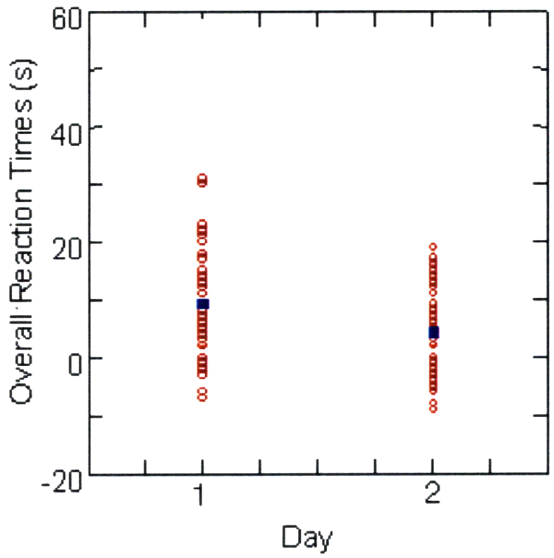

Figure 7.7: Subject 7 Reaction Times per Day

Subject 7 performed the experiment on the first day without the help of [PI] and with [PI] assistance on the second. As all the other members of group B, the response time significantly decreased on the second day, as Figure 7.7 shows. The variance of subject 7 is more congruous with that of group A subjects: the response times on both days appear clustered and within a fairly restricted range (especially on the second day), suggesting that subject 7 was more consistent in the signal monitoring strategy than the other group B members.

7.4 Undetected Anomalies

The number of undetected anomalies per subject per day was then analyzed to observe the effects and cross-effects of day and [PI] assistance. The results proved to be the most dramatic of the entire study. The number of undetected anomalies was plotted for every subject with and without the help of [PI], as shown in Figure 7.8.

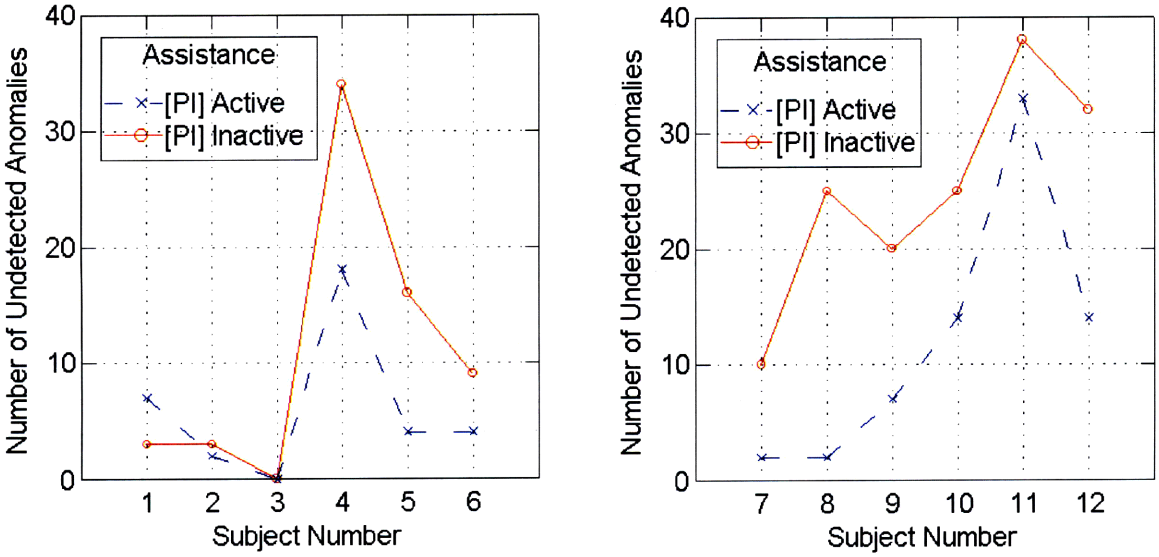

Figure 7.8 (a) and (b): Number of Undetected Anomalies for Groups A & B

By simply looking at the graphs, it is evident that number of undetected anomalies significantly decreased in group B when [PI] was active on the second day. For the subject of group A, the number of undetected anomalies was also generally lower when [PI] was active (first day). The table below shows the effects on the number of undetected anomalies:

Table 7.5: Effects on the Number of Undetected Anomalies

Effects	F	T	P	Mean Effect (anomalies improved)
DAY (D)	1.44	0.805	0.248	4
[PI] Assistance (PI)	4.309	1.93	**0.05**	**9**
PIxD	13.196	1.676	**0.002**	**20.333**

Note that both the effect of [PI] and the cross-effect of [PI] assistance and day were significant in decreasing the number of undetected anomalies. This also suggests an effect of training. The significance of the [PI] effect alone can be attributed to the way [PI] is designed and its graphic user interface: as explained in the previous chapters, whenever an anomaly is detected, a red light next to the appropriate signal is displayed: this obviously facilitates the detection of a signal artifact, since the red light generally catches the subject's attention quite quickly.

7.5 Signal Artifact Identifications

As explained in the experimental protocol, the subjects were asked to identify the anomaly type whenever they detected one. The number of incorrect signal artifact identifications per subject was then studied. A statistical analysis, however, did not show any significant effects or cross-effects.

Table 7.6: Effects on the Number of Wrong Anomaly Identifications

Effects	F	T	p	Mean Effect (decrease in wrong anomaly ID)
DAY (D)	0.003	-0.152	0.957	-0.167
[PI] Assistance (PI)	0.87	-0.932	0.365	-1
PIxD	0.147	0.123	0.706	0.333

While not statistically significant, the cross-effect of [PI] and day seemed to minimally suggest a decrease in the number of incorrect identifications. This, however, was not surprising. Any effect of [PI] assistance alone was not expected and would have been quite puzzling, since when detecting an anomaly, [PI] simply displays a red light and the text "Signal Not Present or Poor Quality" accompanied by the malfunction procedures. [PI] never attempts to identify the type of signal anomaly, therefore the subjects could not be expected to be greatly helped by [PI] alone in this case. Improvement on the number of correct identifications would have been expected as a result of training: the fact that the effect of day alone, or the cross-effect, is not statistically significant suggests that two days may not be enough for subjects to accumulate the necessary experience to be able to categorize the various type of anomalies in real time. The subjects identified the anomalies correctly in the quiz following the training session, but it is clear that the experiment in real-time allows less time to reflect on the anomaly type, therefore requiring more experience and/or training.

7.6 Gender Effects

Throughout the experiment, it was observed that the female subjects outperformed the male subjects. An analysis of variance (ANOVA) revealed the effect of gender on several measurements as shown below:

Table7.7: Gender Effects

			Women performed better than men by...		
Performance on...	**F**	**p**	**with [PI] (s)**	**Without [PI] (s)**	**Mean Difference (s)**
Overall Reaction Time (s)	13.242	**0.002**	6.29	2.62	**4.455**
Popping Reaction Time (s)	11.887	**0.003**	5.967	3.027	**4.515**
Noise Reaction Time (s)	*0.731*	*0.405*	5.833	-3.533	1.15
Flat Reaction Time (s)	16.609	**0**	0.855	-0.1215	**0.367**
Undetected Anomalies	8.904	**0.009**	5.83	-3.53	**6.833**
Wrong ID's	*2.531*	*0.131*	*-2*	*-1.33*	*-1.667 (incorrect ID's)*

As before, the p value indicates where the gender effect was significant. In reaction times and anomaly detections, women reacted more quickly (or detected more anomalies) both with and without the help of [PI]. When considering the overall mean results, the women reacted almost 4.5 seconds faster and detected about six anomalies more than the men. This gender effect could possibly be attributed to the fact that the majority of female subjects was in group B, which received help from [PI] on the second day, therefore greatly benefiting from the cross effect of [PI] assistance and training.

7.7 Discussion

The results obtained from the data analysis presented in this chapter confirmed the hypothesis that a real-time expert system can positively influence subject performance with the calibration of a space life sciences experiment. Even though the effect of [PI] assistance on the reaction times was not statistically significant, it nonetheless showed a positive influence in improving the overall subject performance. When analyzing the signal types individually, the only artifact type that did not seem to be greatly affected by [PI] assistance was the noise signal. As explained in the previous sections, the very

"noisy" nature of the electrophysiological signals, combined with the relatively small amount of training, may have rendered the monitoring process difficult.

Aside from subject reaction, the most dramatic effect of [PI] was observed with the number of undetected anomalies, where even the influence of [PI] alone was statistically significant: the number of undetected anomalies significantly decreased with the help of [PI] regardless of the day that the expert system's assistance was administered. Part of this effect can be attributed to the extremely simple and intuitive appearance of the display.

In all the reaction times studied, as well as the number of undetected anomalies, the cross effect of training and [PI] assistance was also significant. This confirms the extreme importance of the training session on both the nature of the experiment and the use of the expert system. Even when the effect of day alone was not statistically significant, it still suggested a positive influence. The subjects tended to perform better on the second experimental day, thanks to the experience accumulated on the first day.

This corresponds to the need for training on *both* the experiment itself and the use of the expert system: there is the danger that the expert system may prove to be counterproductive if the user is not adequately trained to interpret its messages or if the familiarity with the experiment is not satisfactory. This is the reason why the Neurolab crew trained for several months on the sleep experiment as well as the use of the expert systems. The same intensity of training, even if on a smaller scale due to time constraints, has been arranged for the STS-95 crew.

In future ground-based studies, it would be appropriate to greatly increase the number of training hours until the subjects are fully confident with the experimental procedures

and the use of the expert system: it is very possible that more training would have impacted the number of incorrectly identified anomalies in a positive and significant way, which would have greatly benefited the user with the troubleshooting procedures, had the sleep experiment been fully replicated.

Chapter 8

Conclusions and Recommendations

8.1 Summary

The pilot study analyzed in this thesis was run during the month of January 1998 to collect preliminary data on the efficacy of [PI]. This study was divided in two very distinct phases: one geared especially towards the evaluation of [PI]'s heuristics, and the other phase used [PI] and the Neurolab Sleep experiment as models for the evaluation of an expert system-aided space life sciences experiment. For this phase of the study, the Neurolab Sleep experiment was partly replicated for the ground-based testing which employed a total of twelve subjects. The observations made from the data analysis therefore, are not just specific to [PI], but can be extended to real-time expert systems within the same task domain (medical diagnostics). Results from the study showed that the implementation of an expert system helped decrease the signal artifact detection time and dramatically reduced the number of undetected anomalies. The influence of training, however, played a key role in overall subject performance.

8.2 Iteration and Future Steps

As explained in the first chapter, the evaluation of an expert system (especially in the medical field) is an iterative process that involves a number of different steps and it continues until the program is fully disseminated. Figure 1.1 shows what the status was within the iterative process when the pilot study was run. The observation made from the

Neurolab mission will also contribute to more observations on the expert system's operation and efficiency, taking the process a step forward in preparation for the STS-95 Space Shuttle Mission scheduled for October 1998.

8.3 Recommendations for Future Studies

This study provided a number of critical insights that will prove very useful in future and more complete evaluation studies. While providing a great amount of good quality data to analyze, the study suffered from several shortcomings that should be avoided in future ground-based studies on [PI] or similar expert systems. Due to several constraints, the study was designed and organized in a very short amount of time, using the resources available at that particular moment. Perhaps the most obvious problem encountered was the impossibility of dividing the subjects into two gender-balanced groups due to their conflicting schedules and the pilot study's deadline: while the gender effects encountered were very interesting, it remains to be seen if gender-balanced groups could have diminished or completely abolished the effect of gender on subject performance.

As explained in the previous chapters, the data file used for the study was obtained from an actual recording of one of the astronauts' training sessions. There was no control over the order, spacing and nature of the anomalies contained in the file. In the future, it would be beneficial to artificially create data files with the help of BWH sleep technicians. This would allow the use of data files with more homogeneously distributed signal artifacts and would also permit more control over the anomalies that subjects are presented with. Since humans are poor monitors[1], a more various and eventful data file is

[1]Sheridan

certain to keep the subjects' attention levels higher, a factor that would surely increase their performance. While no learning effects were observed in this study, it would also be advisable to fabricate two distinct data files of equal difficulty to completely avoid any learning influence.

Poor signal quality identification was the only aspect of [PI] analyzed for this experiment. Aside from displaying data and alerting the user of a poor quality signal, [PI] shows a series of malfunction procedures on its diagnostic box: this troubleshooting capability is a very important feature whose efficacy should also be evaluated in future studies. As proposed to the National Space Biomedical Research Institute (NSBRI), a longer, multi-phased, ground-based study would provide more definite results on the use of expert systems not only as signal artifact identifiers, but also as more complete troubleshooting and calibration aids. The proposed study should be broken down in three phases: signal artifact recognition (like the study presented in this thesis), troubleshooting efficacy, and finally the full experiment setup and calibration. Using [PI] for the Sleep experiment, the third phase would then consist of the full Neurolab experiment setup, as opposed to the simplified and abbreviated version used for this thesis.

8.4 The Future of [PI]

The current version of [PI] is going to be updated for the upcoming STS-95 mission. The revisions encompass both the graphic user interface and the heuristics contained in the CLIPS based reasoning engine. Some other lower priority modifications will be made, as time allows, to make [PI] easier to use in light of future ground studies. A list of proposed changes, based on the conclusions on [PI]'s evaluation shown in Appendix

D, was assembled with the assistance of the Sleep Team from NASA Ames and Brigham and Women's Hospital. Proposed changes include a different format of raw data files (which would extremely facilitate data extraction and formatting) as well as other ways to display and control the amount of text displayed in the diagnostic window in order to decrease the amount of mental workload and, therefore, the likelihood of errors.

8.5 The Future of Expert Systems and Space Life Sciences

With the advent of new technologies and artificial intelligence techniques, many tasks that used to be performed by humans have become fully automated. In the medical and life sciences field, however, technology has been implemented not to replace, but to assist the operator. Human supervisory control has found a variety of applications where the human is still required to "be in the loop." Space Life Sciences is one of these fields: as the number of long duration flights increases, as well as the time between training sessions and the actual missions, the need for real time expert systems to aid astronauts in a variety of activities will also increase. In the event of space exploration, such as a mission to Mars, communication with the Earth is bound to become more difficult, decrease in frequency, and increase in time delay. The current version of [PI], developed for the Sleep Experiment, was designed to assist the crew with the calibration and troubleshooting of the system during the pre-sleep period. This study showed that expert systems can help trained users (e.g. astronauts) to identify signal anomalies successfully during the calibration stage of an experiment. In future expert system applications, however, it will be beneficial to expand [PI]'s horizons to include other functions that can alleviate the astronauts' workload and improve their performance, especially when they

cannot rely on communication with the ground. The possibilities are many: one of the more ambitious future goals is to enable [PI] to formulate new experimental models for conducting exploratory analysis and assistance in those situations where standard experimental models do not provide the expected data or fail for some unforeseen reasons. Currently, NASA Ames is studying artificial intelligence applications to advise scientists on model formulation through expert systems, databases, and web-based information sharing systems. Ideally, [PI] would be able to accomplish these tasks in the future. Aside from the artificial intelligence research described above, other activities should include a survey of future shuttle or ISS missions and experiments which would benefit from the help of a real time [PI]-like expert system.

8.6 Liftoff

On April 17, 1998, at 2:19 EDT, the last and largest Space Life Sciences mission ever, called Neurolab, was launched. The mission, containing 26 separate experiments, was geared towards the study of the human brain and nervous system using animal and human subjects. The "Sleep, Respiration and Melatonin in Microgravity" experiment was designed to study the effects of micro-gravity on the human body and circadian rhythms, as well as the efficacy of melatonin as a hypnotic. The state-of-the-art instrumentation provided for the sleep study was accompanied by the first real-time expert system ever developed as an integrating part of a space life sciences experiment, called Principal Investigator-in-a-Box. MIT, NASA Ames and BWH collaborated on this project with success: there is every reason to believe that this collaboration will set a precedent for future joint efforts in the developments of newer, better and more powerful

incarnations of [PI] which will benefit the Space Program and man's quest for knowledge in space and on our planet.

Chapter 9

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APPENDIX A

Neurolab Sleep Experiment Instrumentation and Calibration Procedures[1]

The procedures presented on the following pages only constitute a small part of the actual sleep procedure checklist.

[1] Excerpt from the Sleep Experiment Prodedures Checklist, Science Payloads Management Office, Mission Management Office, Lyndon B. Johnson Space Center, Houston, TX.

VELCRO

VELCRO

R4W

SLEEP INSTRUMENTATION

I. Equipment Setup

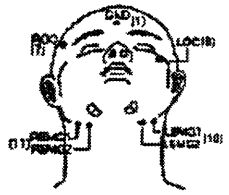
1. Connect Voltage Adapter and cables to Thinkpad
2. DC UTIL PWR, Voltage Adapter – ON
3. Connect RS-232 cable to Thinkpad
4. Thinkpad PWR - ON

II. RIP suit and ECG

1. Don RIP suit, RIP Pocket, Arm Band
2. Apply ECG pads

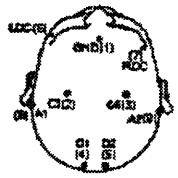
III. Sleepnet

1. Prep sites w/ alcohol pads
2. Don Sleepnet
3. Align Sleepnet properly
4. Prep sites w/ Nuprep swabs
5. Insert Biosensors into each sites
6. Verify 13 electrodes have biosensors
7. Verify impedance under 10 Kohms
8. Reapply electrodes as needed



IV. Borg Harness

1. Secure Borg harness to RIP suit
2. Apply microphone
3. Apply airflow sensor
4. Apply Pulse-Ox sensor
5. Connect RIP suit connector to Borg harness
6. Connect ECG leads to ECG pads



V. DSR

1. Replace DSR old battery w/ fresh batteries
2. Insert DSR PCMCIA card into DSR slot
3. Connect Sleepnet to Sleep connector of DSR
4. Connect Borg harness to Borg Harness connector of DSR
5. Connect Event marker LEMO plug to DSR port marked MRK
6. DSR power-ON
7. Verify battery > 6.00 V
8. Enter Patient ID: MS1 = 1 MS2 = 2 MS3 = 3
   PS1 = 4 PS2 = 5 APS1 = 6
   APS2 = 7 PLT = 8 CDR = 9
9. Set MET DD:HH:MM
10. Set def-file to 'Sleep_090597.def'
11. Start DSR recording
12. Verify DSR recording data
13. Write DSR Serial #, Subj. ID, MET Start Rec on DSR PCMCIA card label

VI. PI-in-the-box

1. Connect RS-232 cable to ONL port of DSR
2. Both Subj's perform signal verification per Sleep Signal Verification cue card
3. Exit PI-in-the-box, Windows
4. Power down Thinkpad, Voltage Adapter, DC UTIL PWR
5. Disconnect Thinkpad, power cables
6. Disconnect DSR RS-232 cable from Thinkpad and DSR
7. Verify DSR recording data
8. Write 'MET Its out' on DSR PCMCIA card label
9. Press DSR Event Marker to mark beginning of Sleep period
10. Press Actigraphy Event Marker (3x) at Lights Out of every night

Back of SLEEP DEINSTRUMENTATION

Sleep Signal Verification

Operator	Subject
1. Allow subject to relax for 10 sec (Electrophysiocal screen time lapse = 10 sec)	1. Relax for 10 sec
2. √ All signals clean, stable	2. Eyes open, look straight ahead for 5 sec
3. √ EEG signals increase in frequency, amplitude Single click on EEG VER boxes (4)	3. Eyes closed, look straight ahead for 5 sec
4. √ When subj looks left, EOG -L goes up, EOG-R goes down (signals move apart) √ When subj looks right, EOG-L goes down, EOG-R goes up (signals move together)	4. Eyes open, head still Look left for 2 sec Look right for 2 sec Repeat once
5. √ When subj looks up, EOG-R goes up, EOG-L goes down (signals move together) √ When subj looks down, EOG-R goes down, EOG-L goes up (signals move apart)	5. Eyes open, head still Look up for 2 sec Look down for 2 sec Repeat once
6. √ EOG signals move in sync Single click on EOG VER boxes (2)	6. Head still, blink slowly 5 times
8. √ Large amplitude increase in EMG signals Single click on EMG VER boxes (2)	7. Grit teeth for 3 sec
9. Single click on Cardio-respiratory button √ Cardio-respiratory display √ STATE lts - GREEN √ SaO2 > 95%, stable P-wave Single click on SaO2, P-wave VER boxes	8. Hands at sides, eyes forward
10. √ flow signal changes in sync w/breathing maneuver Single click on Flow VER box	9. With mouth closed, inspired to vital capacity then expire to residual volume breathe normally
11. √ Three corresponding microphone signal deflections Single click on mic VER box	10. Make three snoring sounds
12. √ no change in flow signal √ RIP-RC 180° out-of-phase of RIP-AB Single click on RC/AB VER boxes	11. Close glotis, perform isovolume maneuver
13. √ clean stable ECG signal Single click on ECG VER box	12. Relax for 3 sec
14. Single Click Event Marker √ Mrk lt GREEN	

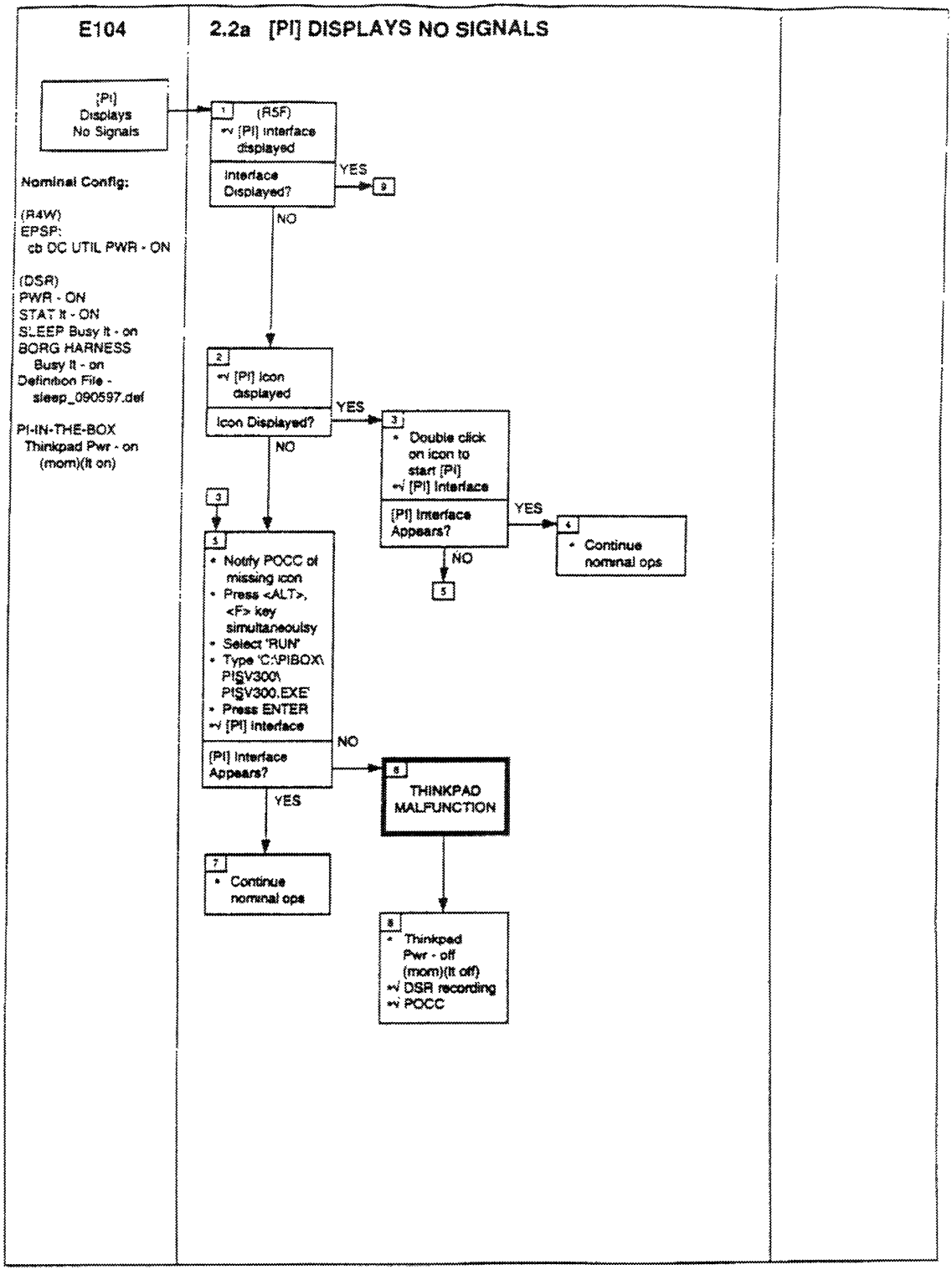
JEP-18a/NL/O/A

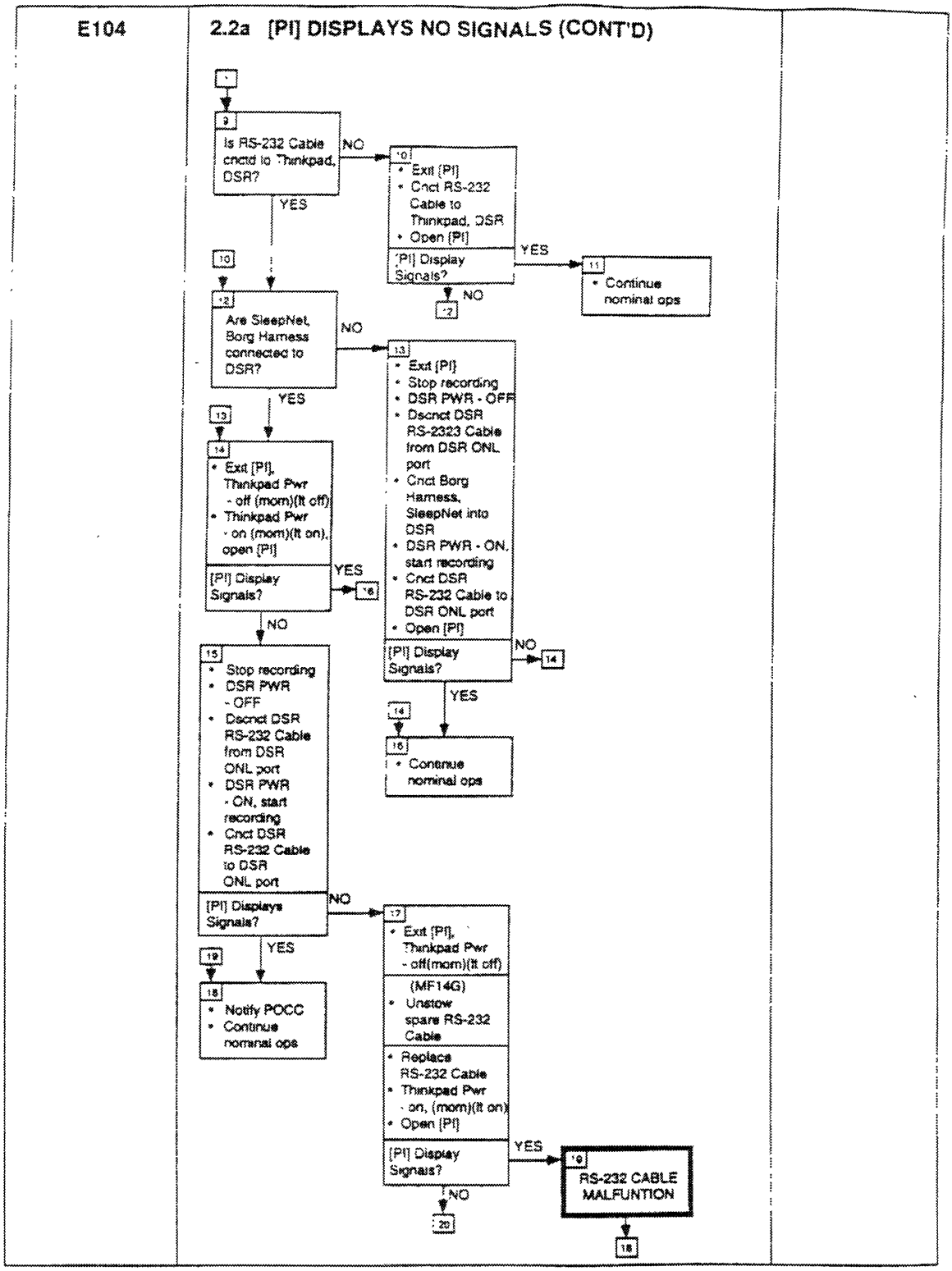
APPENDIX B

Malfunction Procedures[2]

The malfunction procedures reported in this appendix only regard the troubleshooting of the sleep instrumentation and [PI]. Additional procedures regarding the hardware (such as the laptop's operation) were also developed for the experiment, but they are not included in this thesis because they are of no particular interest or relevance to this study.

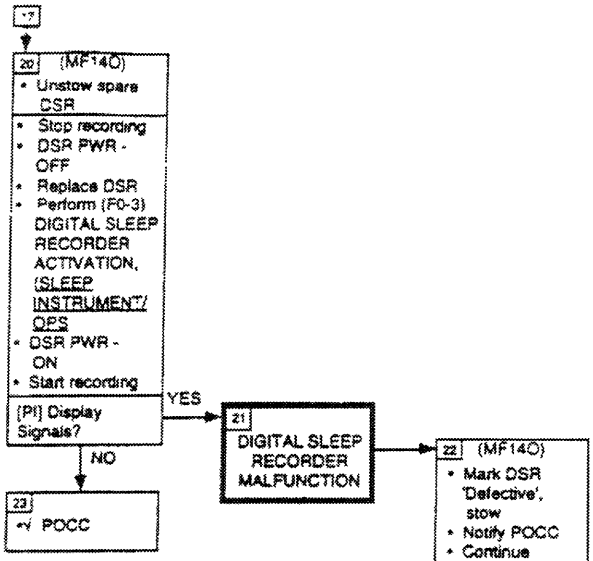
[2] Excerpt from the Sleep Experiment Prodedures Checklist, Science Payloads Management Office, Mission Management Office, Lyndon B. Johnson Space Center, Houston, TX.

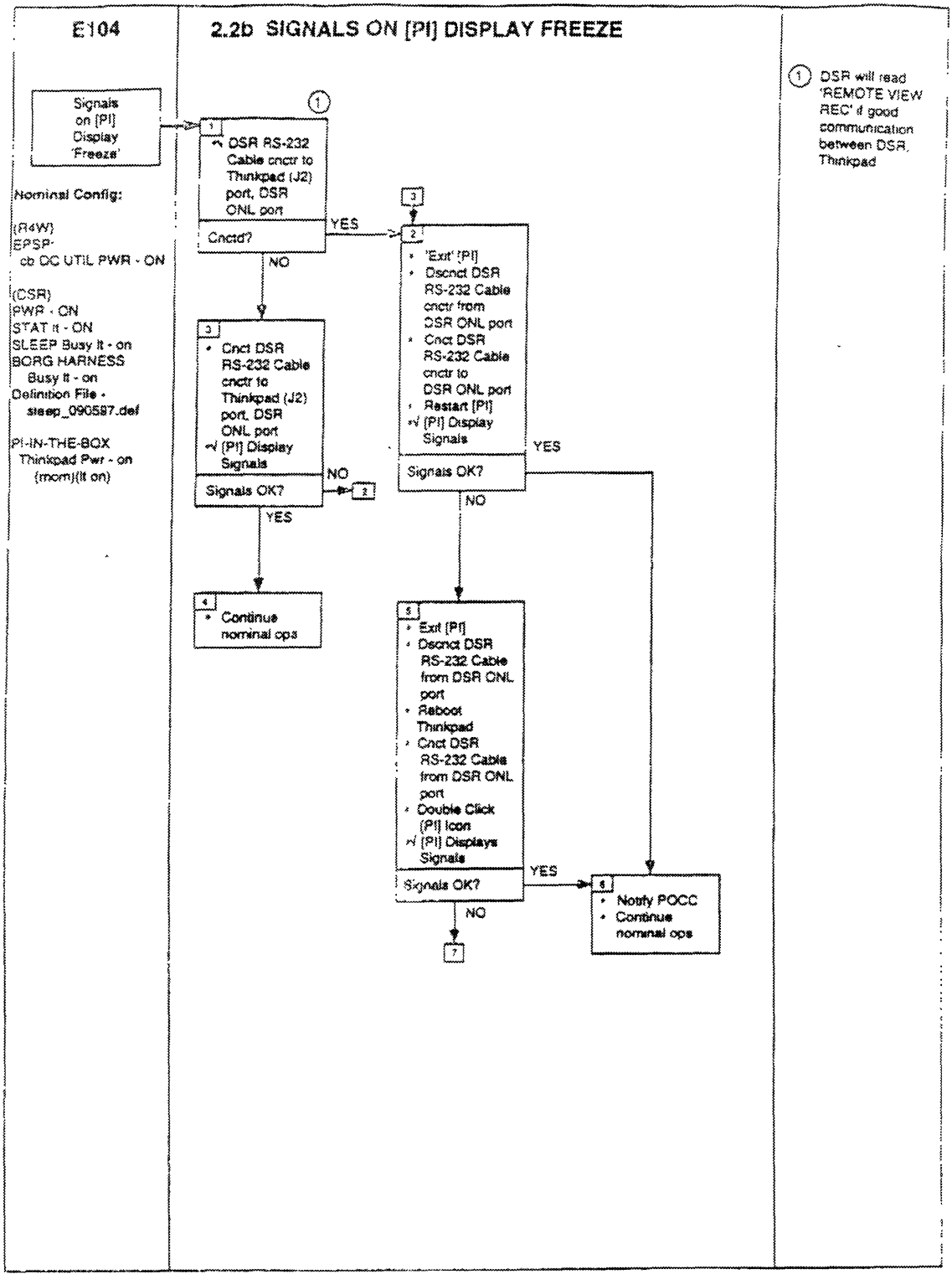

E104
2.2a [PI] DISPLAYS NO SIGNALS
[PI] Displays No Signals
Nominal Config:
(R4W)
EPSP:
cb DC UTIL PWR - ON
(DSR)
PWR - ON
STAT lt - ON
SLEEP Busy lt - on
BORG HARNESS Busy lt - on
Definition File - sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on (mom)(lt on)
1 (R5F)
•√ [PI] interface displayed
Interface Displayed?
YES
NO
2
•√ [PI] Icon displayed
Icon Displayed?
YES
NO
3
• Double click on icon to start [PI]
•√ [PI] Interface
[PI] Interface Appears?
YES
NO
4
• Continue nominal ops
5
• Notify POCC of missing icon
• Press <ALT>, <F> key simultaneoulsy
• Select 'RUN'
• Type 'C:\PIBOX\PISV300\PISV300.EXE'
• Press ENTER
•√ [PI] Interface
[PI] Interface Appears?
NO
YES
6
THINKPAD MALFUNCTION
7
• Continue nominal ops
8
• Thinkpad Pwr - off (mom)(lt off)
•√ DSR recording
•√ POCC


E104
2.2a [PI] DISPLAYS NO SIGNALS (CONT'D)
9
Is RS-232 Cable cnctd to Thinkpad, DSR?
NO
YES
10
• Exit [PI]
• Cnct RS-232 Cable to Thinkpad, DSR
• Open [PI]
[PI] Display Signals?
YES
11
• Continue nominal ops
NO
12
Are SleepNet, Borg Harness connected to DSR?
NO
YES
13
• Exit [PI]
• Stop recording
• DSR PWR - OFF
• Dscnct DSR RS-2323 Cable from DSR ONL port
• Cnct Borg Harness, SleepNet into DSR
• DSR PWR - ON, start recording
• Cnct DSR RS-232 Cable to DSR ONL port
• Open [PI]
[PI] Display Signals?
NO
14
YES
14
16
• Continue nominal ops
13
14
• Exit [PI], Thinkpad Pwr - off (mom)(lt off)
• Thinkpad Pwr - on (mom)(lt on), open [PI]
[PI] Display Signals?
YES
8
NO
15
• Stop recording
• DSR PWR - OFF
• Dscnct DSR RS-232 Cable from DSR ONL port
• DSR PWR - ON, start recording
• Cnct DSR RS-232 Cable to DSR ONL port
[PI] Displays Signals?
NO
17
• Exit [PI], Thinkpad Pwr - off(mom)(lt off)
(MF14G)
• Unstow spare RS-232 Cable
• Replace RS-232 Cable
• Thinkpad Pwr - on, (mom)(lt on)
• Open [PI]
[PI] Display Signals?
YES
8
RS-232 CABLE MALFUNTION
18
NO
20
YES
19
18
• Notify POCC
• Continue nominal ops

E104

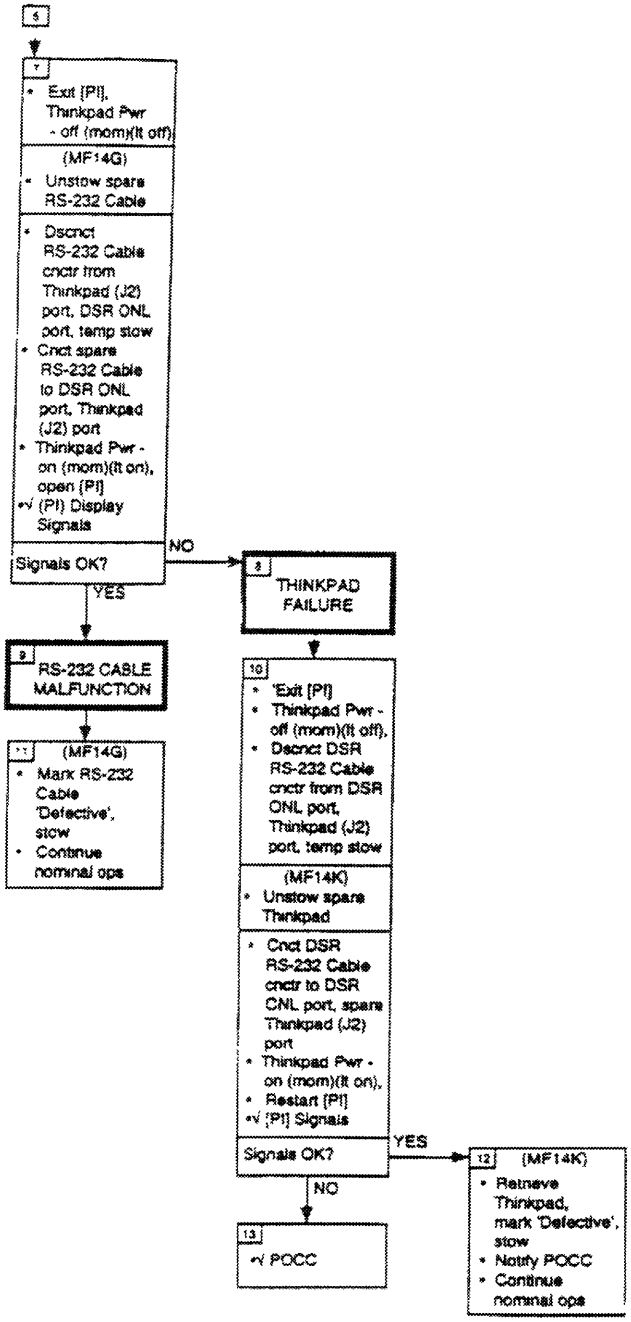
2.2a [PI] DISPLAYS NO SIGNALS (CONT'D)

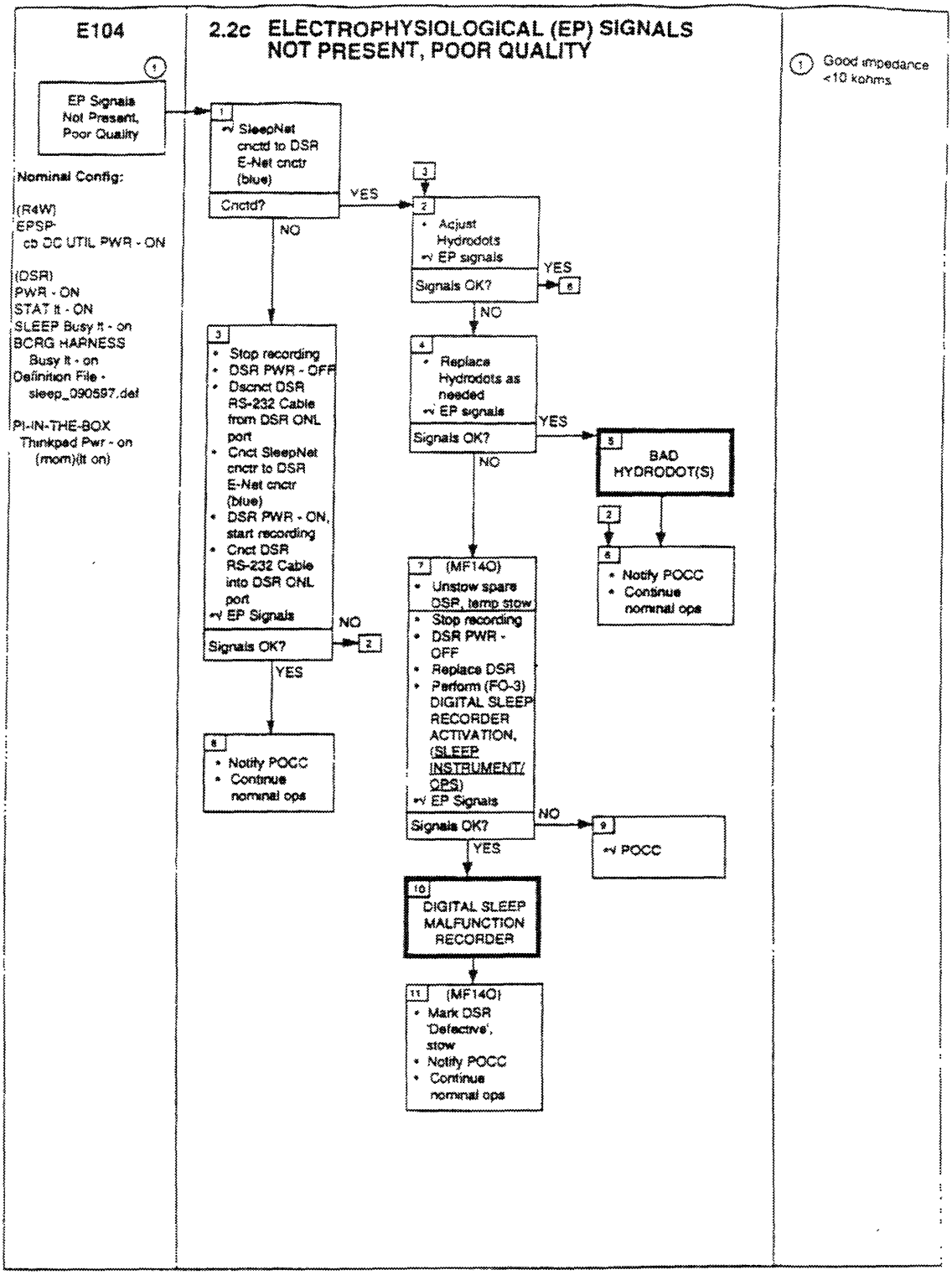


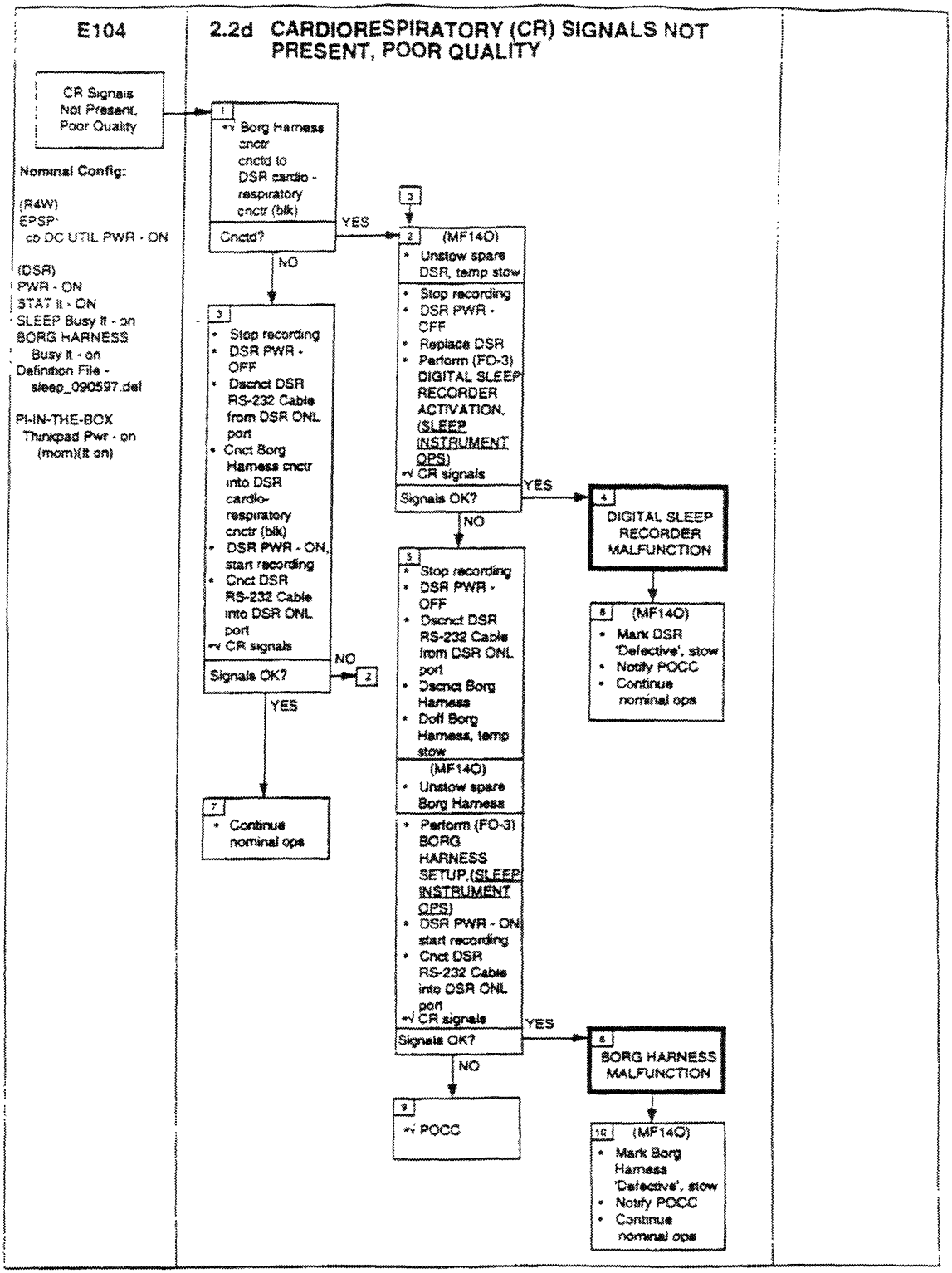

E104
2.2b SIGNALS ON [PI] DISPLAY FREEZE
Signals on [PI] Display 'Freeze'
Nominal Config:
(R4W)
EPSP-
cb DC UTIL PWR - ON
(CSR)
PWR - ON
STAT lt - ON
SLEEP Busy lt - on
BCRG HARNESS
Busy lt - on
Definition File -
sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on
(mom)(lt on)
1
DSR RS-232 Cable cnctr to Thinkpad (J2) port, DSR ONL port
Cnctd?
YES
NO
2
'Exit' [PI]
Dscnct DSR RS-232 Cable cnctr from DSR ONL port
Cnct DSR RS-232 Cable cnctr to DSR ONL port
Restart [PI]
√ [PI] Display Signals
Signals OK?
YES
NO
3
Cnct DSR RS-232 Cable cnctr to Thinkpad (J2) port, DSR ONL port
√ [PI] Display Signals
Signals OK?
NO
YES
4
Continue nominal ops
5
Exit [PI]
Dscnct DSR RS-232 Cable from DSR ONL port
Reboot Thinkpad
Cnct DSR RS-232 Cable from DSR ONL port
Double Click [PI] Icon
√ [PI] Displays Signals
Signals OK?
YES
NO
6
Notify POCC
Continue nominal ops
7
1
DSR will read 'REMOTE VIEW REC' if good communication between DSR, Thinkpad

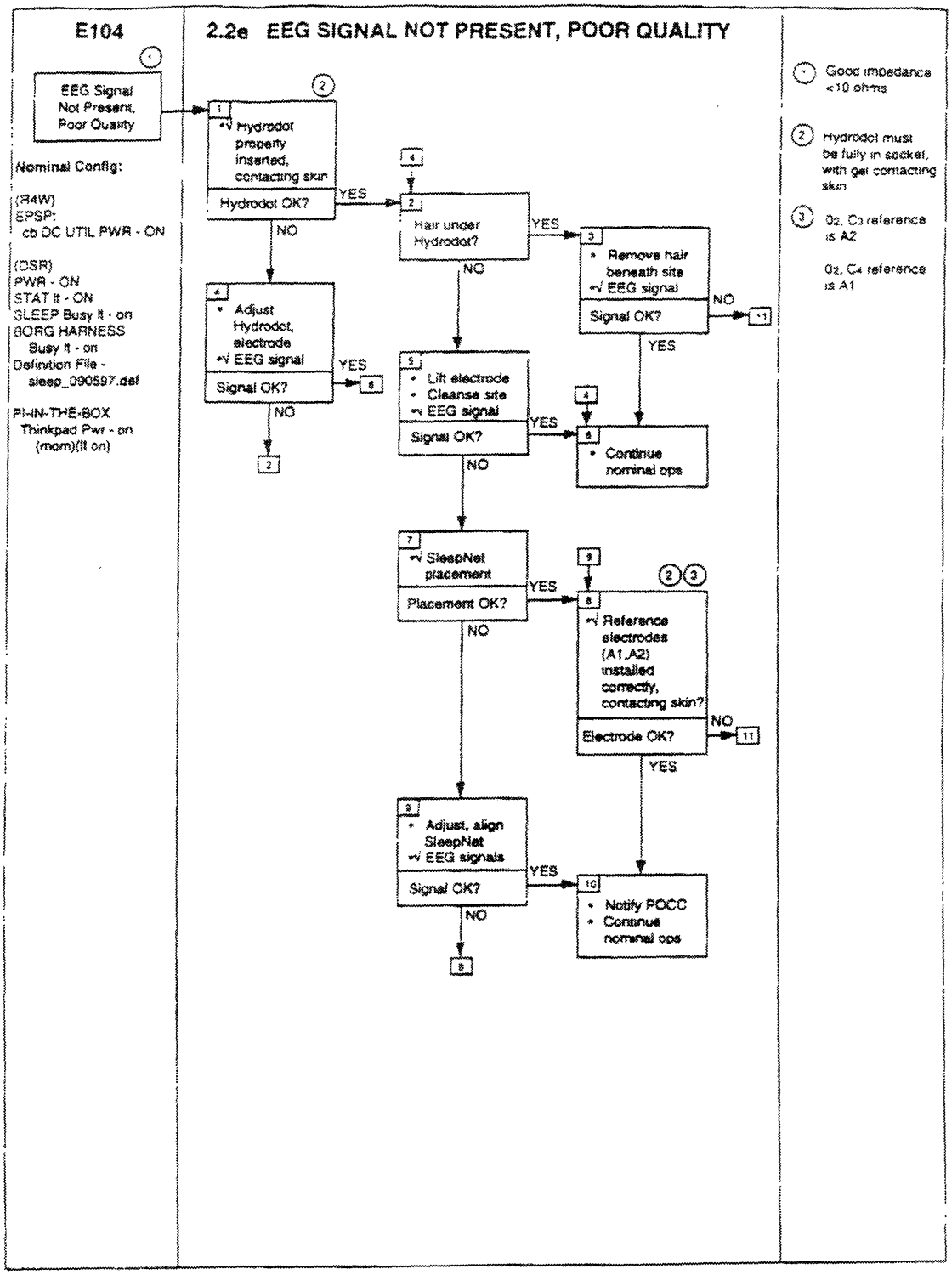
E104

2.2b SIGNALS ON [PI] DISPLAY FREEZE (CONT'D)



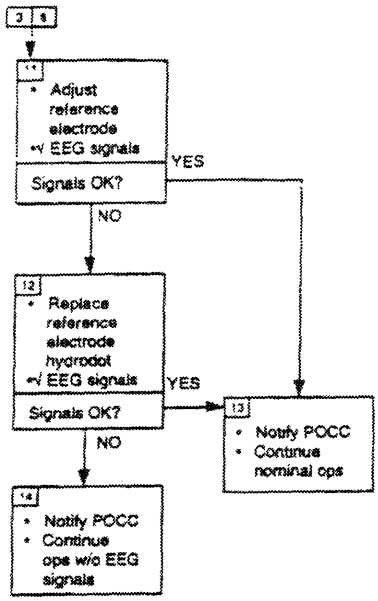

E104
2.2c ELECTROPHYSIOLOGICAL (EP) SIGNALS NOT PRESENT, POOR QUALITY
1 Good impedance <10 kohms
EP Signals Not Present, Poor Quality
Nominal Config:
(R4W)
EPSP-
cb DC UTIL PWR - ON
(DSR)
PWR - ON
STAT lt - ON
SLEEP Busy lt - on
BCRG HARNESS
Busy lt - on
Definition File - sleep_090597.def
PI-IN-THE-BOX
Thinkped Pwr - on
(mom)(lt on)
1
√ SleepNet cnctd to DSR E-Net cnctr (blue)
Cnctd?
YES
NO
2
• Adjust Hydrodots
√ EP signals
Signals OK?
YES
NO
3
• Stop recording
• DSR PWR - OFF
• Dscnct DSR RS-232 Cable from DSR ONL port
• Cnct SleepNet cnctr to DSR E-Net cnctr (blue)
• DSR PWR - ON, start recording
• Cnct DSR RS-232 Cable into DSR ONL port
√ EP Signals
Signals OK?
NO
YES
4
• Replace Hydrodots as needed
√ EP signals
Signals OK?
YES
NO
5
BAD HYDRODOT(S)
6
• Notify POCC
• Continue nominal ops
7 (MF14O)
• Unstow spare DSR, temp stow
• Stop recording
• DSR PWR - OFF
• Replace DSR
• Perform (FO-3) DIGITAL SLEEP RECORDER ACTIVATION, (SLEEP INSTRUMENT/ OPS)
√ EP Signals
Signals OK?
NO
YES
9
√ POCC
10
DIGITAL SLEEP MALFUNCTION RECORDER
11 (MF14O)
• Mark DSR 'Defective', stow
• Notify POCC
• Continue nominal ops

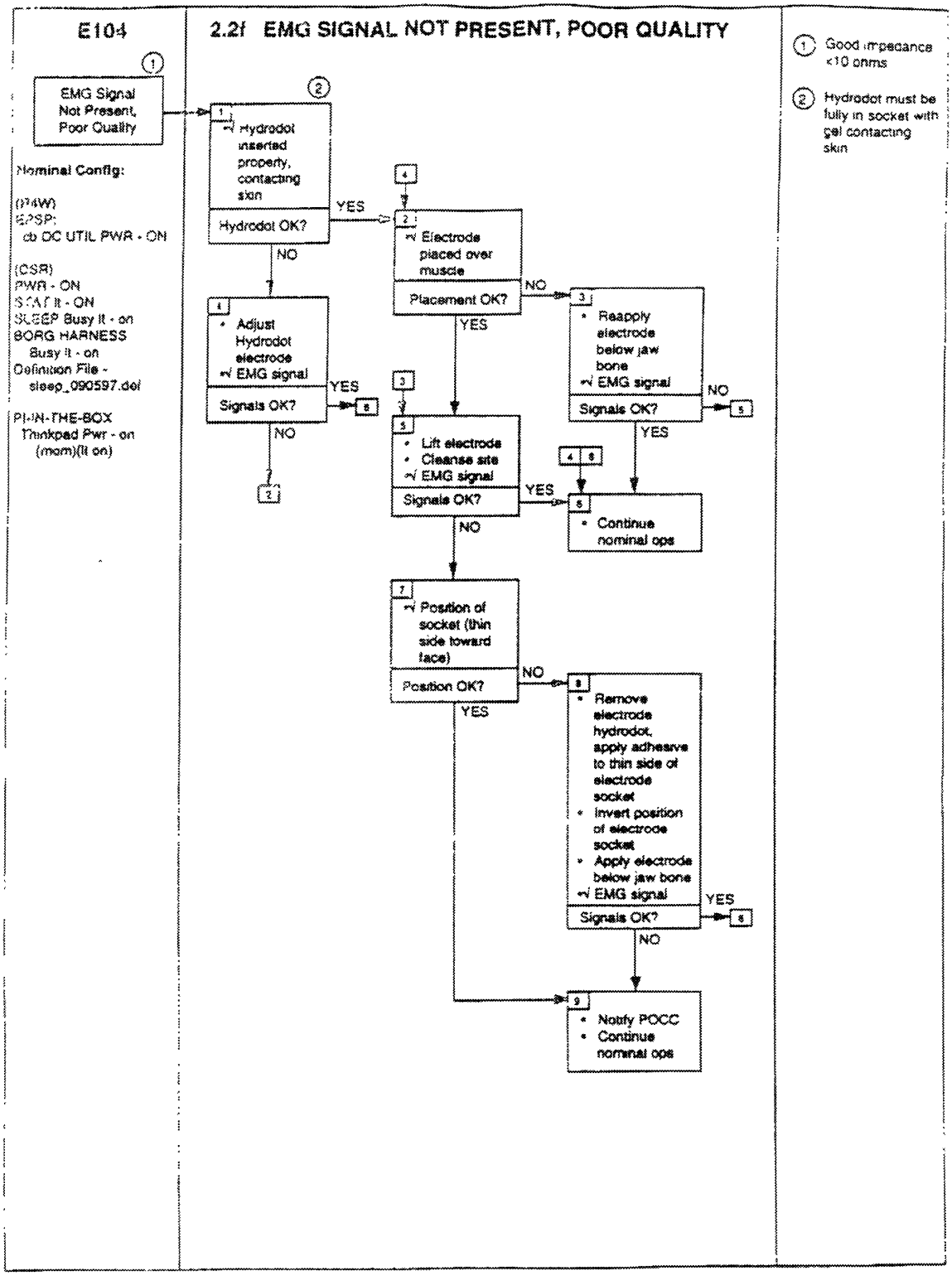

E104
2.2d CARDIORESPIRATORY (CR) SIGNALS NOT PRESENT, POOR QUALITY
CR Signals Not Present, Poor Quality
Nominal Config:
(R4W)
EPSP-
cb DC UTIL PWR - ON
(DSR)
PWR - ON
STAT lt - ON
SLEEP Busy lt - on
BORG HARNESS
Busy lt - on
Definition File -
sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on
(mom)(lt on)
1
√ Borg Harness cnctr cnctd to DSR cardio - respiratory cnctr (blk)
Cnctd?
YES
NO
2
(MF14O)
Unstow spare DSR, temp stow
Stop recording
DSR PWR - OFF
Replace DSR
Perform (FO-3) DIGITAL SLEEP RECORDER ACTIVATION. (SLEEP INSTRUMENT OPS)
√ CR signals
Signals OK?
YES
NO
3
Stop recording
DSR PWR - OFF
Dscnct DSR RS-232 Cable from DSR ONL port
Cnct Borg Harness cnctr into DSR cardio-respiratory cnctr (blk)
DSR PWR - ON, start recording
Cnct DSR RS-232 Cable into DSR ONL port
√ CR signals
Signals OK?
NO
YES
4
DIGITAL SLEEP RECORDER MALFUNCTION
5
(MF14O)
Mark DSR 'Defective', stow
Notify POCC
Continue nominal ops
6
Stop recording
DSR PWR - OFF
Dscnct DSR RS-232 Cable from DSR ONL port
Dscnct Borg Harness
Doff Borg Harness, temp stow
(MF14O)
Unstow spare Borg Harness
Perform (FO-3) BORG HARNESS SETUP.(SLEEP INSTRUMENT OPS)
DSR PWR - ON, start recording
Cnct DSR RS-232 Cable into DSR ONL port
√ CR signals
Signals OK?
YES
NO
7
Continue nominal ops
8
BORG HARNESS MALFUNCTION
9
√ POCC
10
(MF14O)
Mark Borg Harness 'Defective', stow
Notify POCC
Continue nominal ops

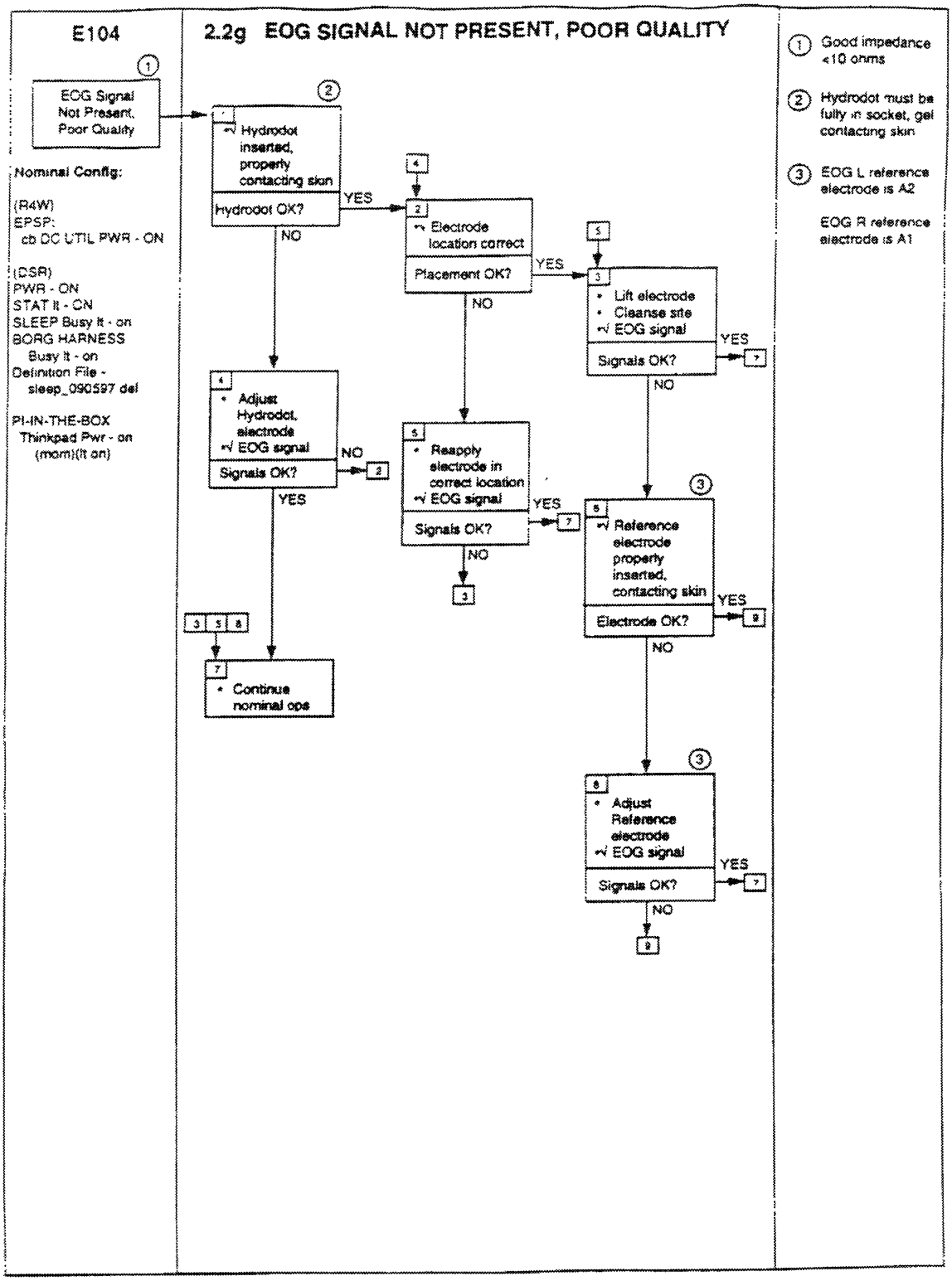

E104
2.2e EEG SIGNAL NOT PRESENT, POOR QUALITY
EEG Signal Not Present, Poor Quality
Nominal Config:
(R4W)
EPSP:
cb DC UTIL PWR - ON
(DSR)
PWR - ON
STAT lt - ON
SLEEP Busy lt - on
BORG HARNESS
Busy lt - on
Definition File -
sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on
(mom)(lt on)
√ Hydrodot properly inserted, contacting skin
Hydrodot OK?
YES
NO
Hair under Hydrodot?
YES
NO
Remove hair beneath site
√ EEG signal
Signal OK?
NO
YES
Adjust Hydrodot, electrode
√ EEG signal
Signal OK?
YES
NO
Lift electrode
Cleanse site
√ EEG signal
Signal OK?
YES
NO
Continue nominal ops
√ SleepNet placement
Placement OK?
YES
NO
√ Reference electrodes (A1,A2) installed correctly, contacting skin?
Electrode OK?
NO
YES
Adjust, align SleepNet
√ EEG signals
Signal OK?
YES
NO
Notify POCC
Continue nominal ops
Good impedance <10 ohms
Hydrodot must be fully in socket, with gel contacting skin
O2, C3 reference is A2
O2, C4 reference is A1

E104

2.2e EEG SIGNAL NOT PRESENT, POOR QUALITY (CONT'D)

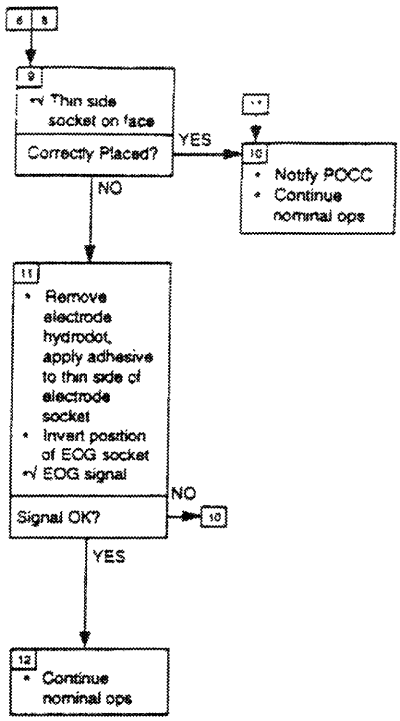


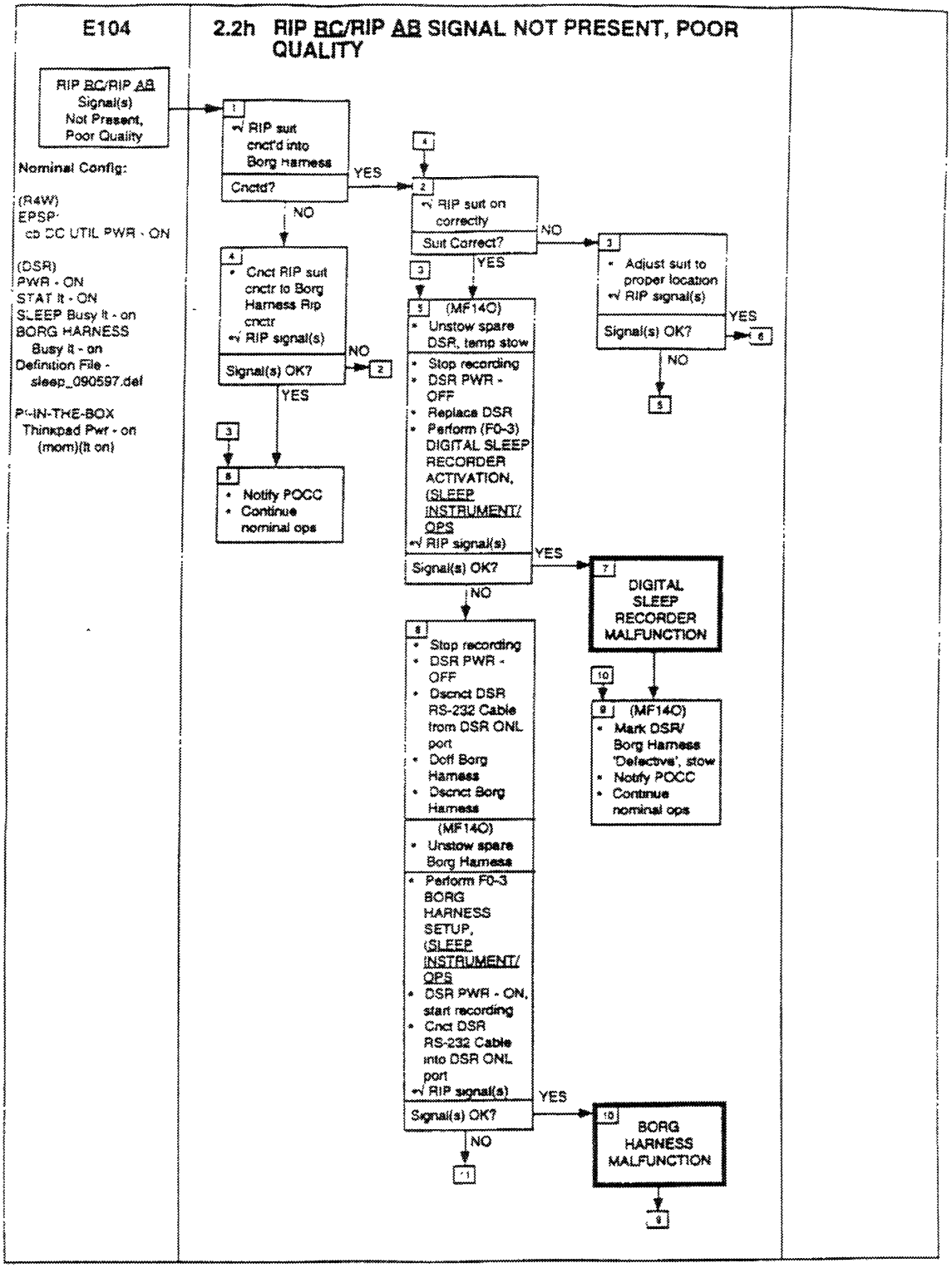

E104
2.2f EMG SIGNAL NOT PRESENT, POOR QUALITY
EMG Signal Not Present, Poor Quality
Nominal Config:
(P4W)
SPSP:
db OC UTIL PWR - ON
(CSR)
PWR - ON
START it - ON
SLEEP Busy it - on
BORG HARNESS
Busy it - on
Definition File -
sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on
(mom)(lt on)
Hydrodot inserted properly, contacting skin
Hydrodot OK?
YES
NO
Electrode placed over muscle
Placement OK?
NO
YES
Reapply electrode below jaw bone
EMG signal
Signals OK?
NO
YES
Adjust Hydrodot electrode
EMG signal
Signals OK?
YES
NO
Lift electrode
Cleanse site
EMG signal
Signals OK?
YES
NO
Continue nominal ops
Position of socket (thin side toward face)
Position OK?
NO
YES
Remove electrode hydrodot, apply adhesive to thin side of electrode socket
Invert position of electrode socket
Apply electrode below jaw bone
EMG signal
Signals OK?
YES
NO
Notify POCC
Continue nominal ops
1 Good impedance <10 ohms
2 Hydrodot must be fully in socket with gel contacting skin


E104
2.2g EOG SIGNAL NOT PRESENT, POOR QUALITY
EOG Signal Not Present, Poor Quality
Nominal Config:
(R4W)
EPSP:
cb DC UTIL PWR - ON
(DSR)
PWR - ON
STAT lt - ON
SLEEP Busy lt - on
BORG HARNESS
Busy lt - on
Definition File -
sleep_090597 def
PI-IN-THE-BOX
Thinkpad Pwr - on
(mom)(lt on)
Hydrodot inserted, properly contacting skin
Hydrodot OK?
YES
NO
Electrode location correct
Placement OK?
YES
NO
Lift electrode
Cleanse site
EOG signal
Signals OK?
YES
NO
Adjust Hydrodot, electrode
EOG signal
Signals OK?
NO
YES
Reapply electrode in correct location
EOG signal
Signals OK?
YES
NO
Reference electrode properly inserted, contacting skin
Electrode OK?
YES
NO
Adjust Reference electrode
EOG signal
Signals OK?
YES
NO
Continue nominal ops
1 Good impedance <10 ohms
2 Hydrodot must be fully in socket, gel contacting skin
3 EOG L reference electrode is A2
EOG R reference electrode is A1

E104

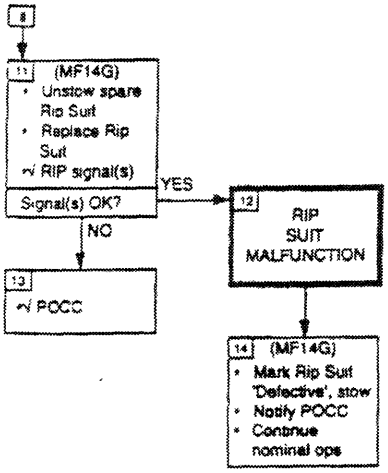
2.2g EOG SIGNAL NOT PRESENT, POOR QUALITY (CONT'D)

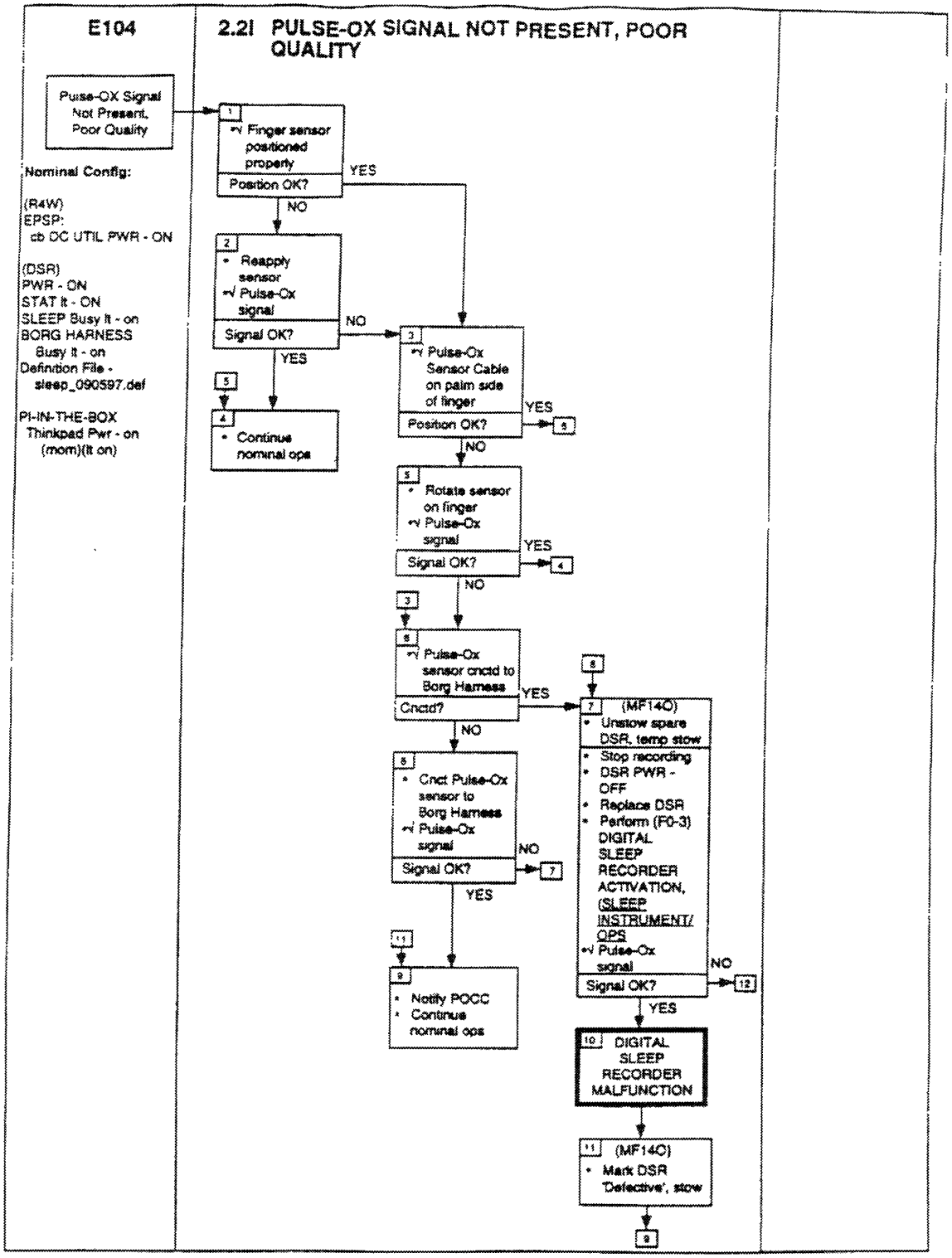



E104
2.2h RIP BC/RIP AB SIGNAL NOT PRESENT, POOR QUALITY
RIP BC/RIP AB Signal(s) Not Present, Poor Quality
Nominal Config:
(R4W)
EPSP-
cb DC UTIL PWR - ON
(DSR)
PWR - ON
STAT lt - ON
SLEEP Busy lt - on
BORG HARNESS Busy lt - on
Definition File - sleep_090597.del
P-IN-THE-BOX Thinkpad Pwr - on (morn)(lt on)
1
√ RIP suit cnct'd into Borg Harness
Cnctd?
YES
NO
2
√ RIP suit on correctly
Suit Correct?
NO
YES
3
• Adjust suit to proper location
√ RIP signal(s)
Signal(s) OK?
YES
NO
4
• Cnct RIP suit cnctr to Borg Harness Rip cnctr
√ RIP signal(s)
Signal(s) OK?
NO
YES
5
(MF14O)
• Unstow spare DSR, temp stow
• Stop recording
• DSR PWR - OFF
• Replace DSR
• Perform (F0-3) DIGITAL SLEEP RECORDER ACTIVATION, (SLEEP INSTRUMENT/ OPS
√ RIP signal(s)
Signal(s) OK?
YES
NO
6
• Notify POCC
• Continue nominal ops
7
DIGITAL SLEEP RECORDER MALFUNCTION
8
• Stop recording
• DSR PWR - OFF
• Dscnct DSR RS-232 Cable from DSR ONL port
• Doff Borg Harness
• Dscnct Borg Harness
(MF14O)
• Unstow spare Borg Harness
• Perform F0-3 BORG HARNESS SETUP, (SLEEP INSTRUMENT/ OPS
• DSR PWR - ON, start recording
• Cnct DSR RS-232 Cable into DSR ONL port
√ RIP signal(s)
Signal(s) OK?
YES
NO
9
(MF14O)
• Mark DSR/ Borg Harness 'Defective', stow
• Notify POCC
• Continue nominal ops
10
BORG HARNESS MALFUNCTION

E104

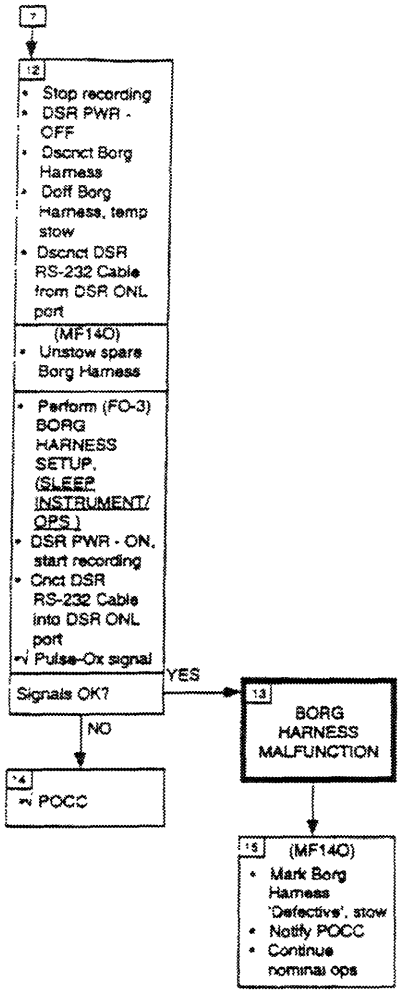
2.2h RIP RC/RIP AB SIGNAL NOT PRESENT, POOR QUALITY (CONT'D)

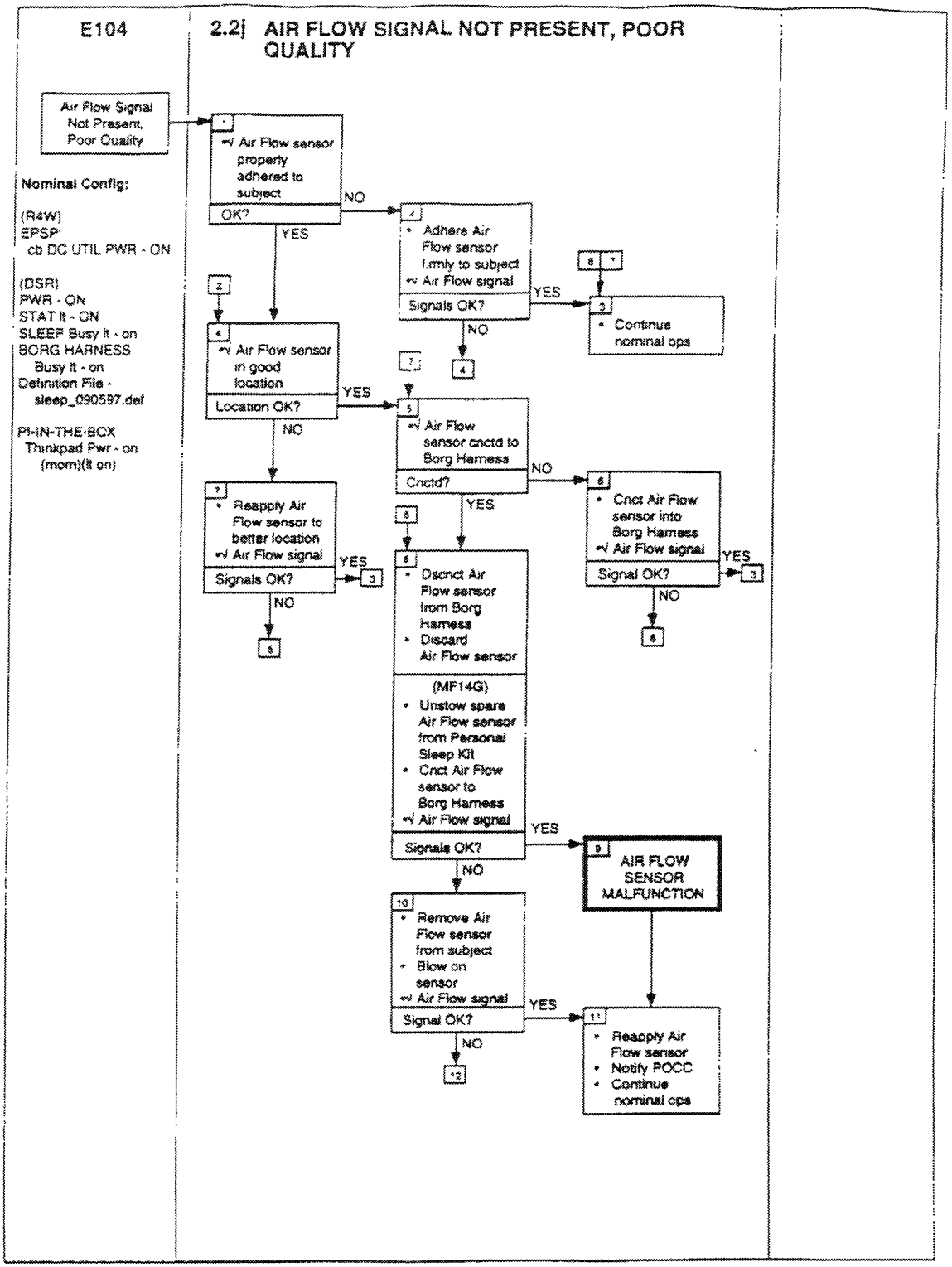



E104
2.2I PULSE-OX SIGNAL NOT PRESENT, POOR QUALITY
Pulse-OX Signal Not Present, Poor Quality
Nominal Config:
(R4W)
EPSP:
cb DC UTIL PWR - ON
(DSR)
PWR - ON
STAT lt - ON
SLEEP Busy lt - on
BORG HARNESS
Busy lt - on
Definition File -
sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on
(mom)(lt on)
1
√ Finger sensor positioned properly
Position OK?
YES
NO
2
• Reapply sensor
√ Pulse-Ox signal
Signal OK?
NO
YES
3
√ Pulse-Ox Sensor Cable on palm side of finger
Position OK?
YES
NO
4
• Continue nominal ops
5
5
• Rotate sensor on finger
√ Pulse-Ox signal
Signal OK?
YES
NO
3
6
√ Pulse-Ox sensor cnctd to Borg Harness
Cnctd?
YES
NO
8
• Cnct Pulse-Ox sensor to Borg Harness
√ Pulse-Ox signal
Signal OK?
NO
YES
7
11
9
• Notify POCC
• Continue nominal ops
8
7 (MF14O)
• Unstow spare DSR, temp stow
• Stop recording
• DSR PWR - OFF
• Replace DSR
• Perform (F0-3) DIGITAL SLEEP RECORDER ACTIVATION, (SLEEP INSTRUMENT/ OPS
√ Pulse-Ox signal
Signal OK?
NO
YES
12
10 DIGITAL SLEEP RECORDER MALFUNCTION
11 (MF14O)
• Mark DSR 'Defective', stow
9

E104

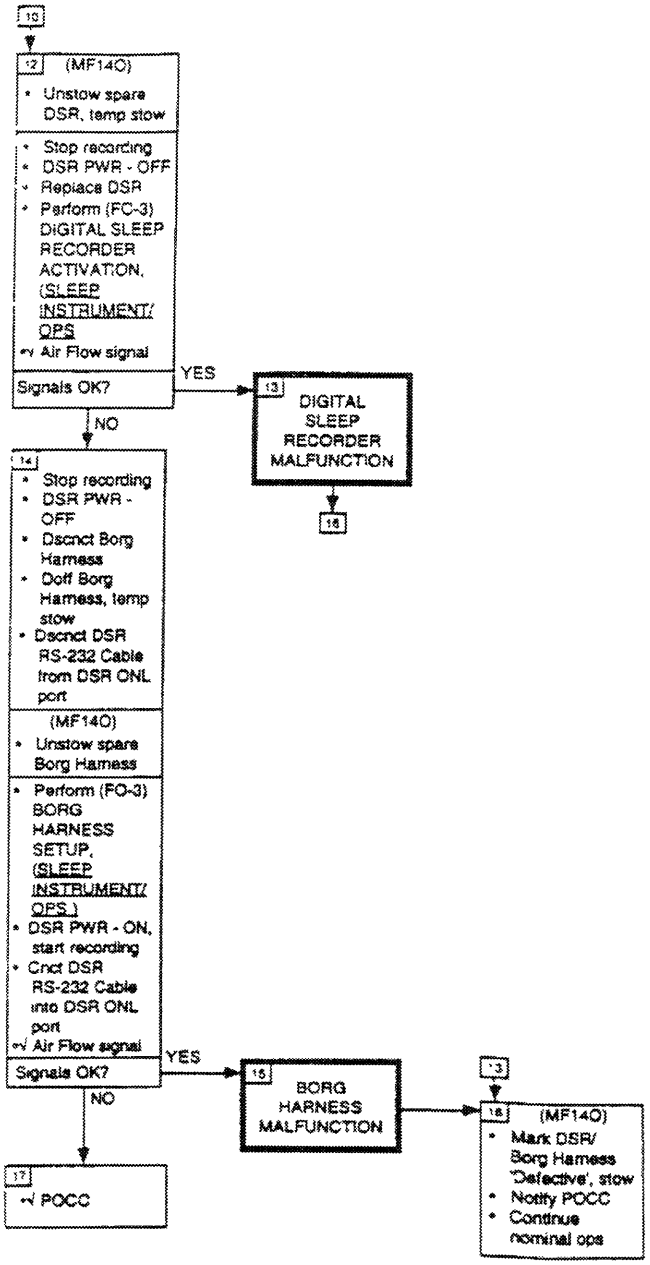
2.2i PULSE-OX SIGNAL NOT PRESENT, POOR QUALITY (CONT'D)

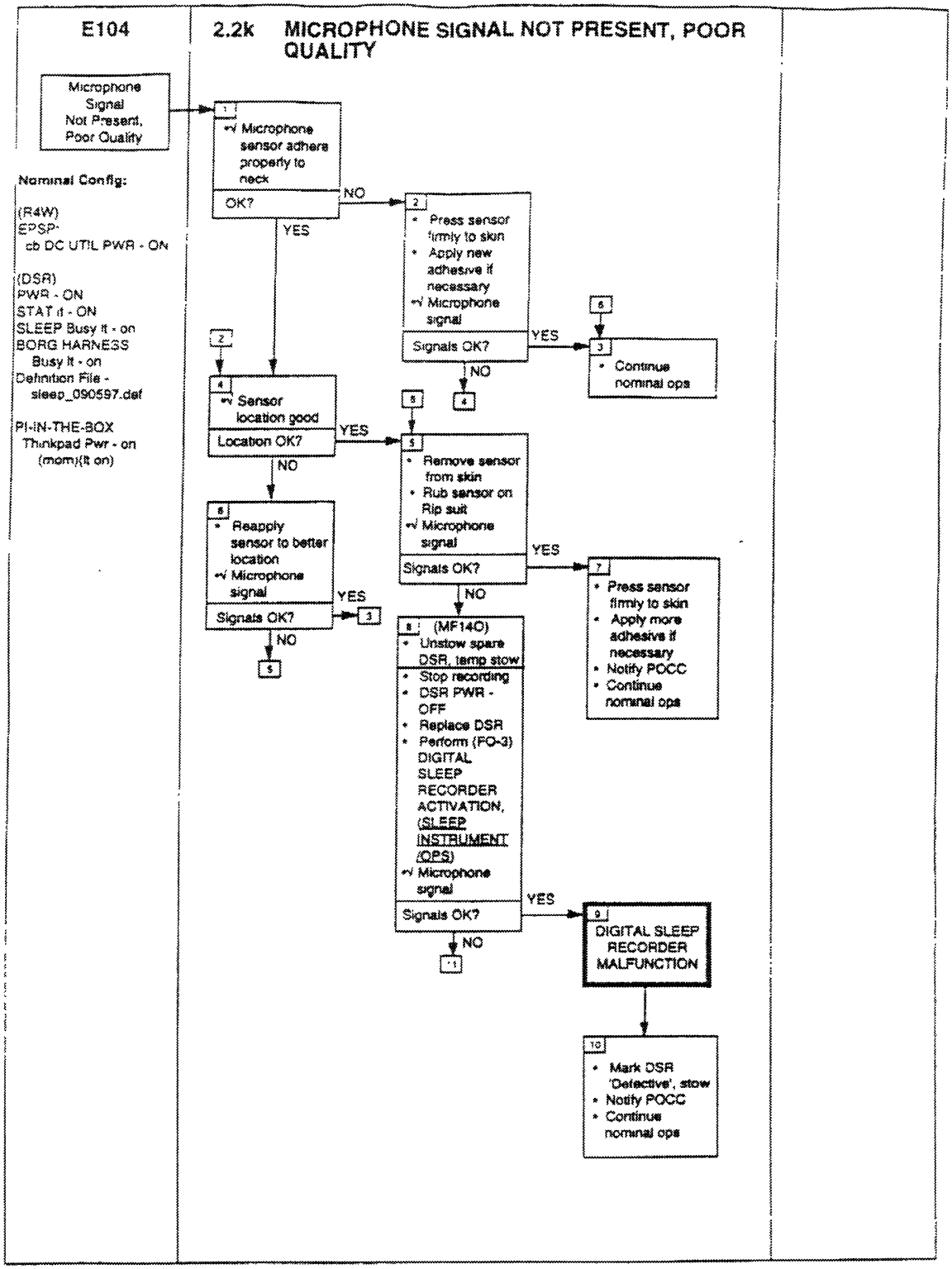



E104
2.2| AIR FLOW SIGNAL NOT PRESENT, POOR QUALITY
Air Flow Signal Not Present, Poor Quality
Nominal Config:
(R4W)
EPSP
cb DC UTIL PWR - ON
(DSR)
PWR - ON
STAT lt - ON
SLEEP Busy lt - on
BORG HARNESS
Busy lt - on
Definition File -
sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on
(mom)(lt on)
1
√ Air Flow sensor properly adhered to subject
OK?
NO
YES
2
4
√ Air Flow sensor in good location
Location OK?
YES
NO
4
Adhere Air Flow sensor firmly to subject
√ Air Flow signal
Signals OK?
YES
NO
6 7
3
Continue nominal ops
7
5
√ Air Flow sensor cnctd to Borg Harness
Cnctd?
NO
YES
6
Cnct Air Flow sensor into Borg Harness
√ Air Flow signal
Signal OK?
YES
NO
3
6
7
Reapply Air Flow sensor to better location
√ Air Flow signal
Signals OK?
YES
NO
3
5
8
8
Dscnct Air Flow sensor from Borg Harness
Discard Air Flow sensor
(MF14G)
Unstow spare Air Flow sensor from Personal Sleep Kit
Cnct Air Flow sensor to Borg Harness
√ Air Flow signal
Signals OK?
YES
NO
9
AIR FLOW SENSOR MALFUNCTION
10
Remove Air Flow sensor from subject
Blow on sensor
√ Air Flow signal
Signal OK?
YES
NO
12
11
Reapply Air Flow sensor
Notify POCC
Continue nominal ops

E104

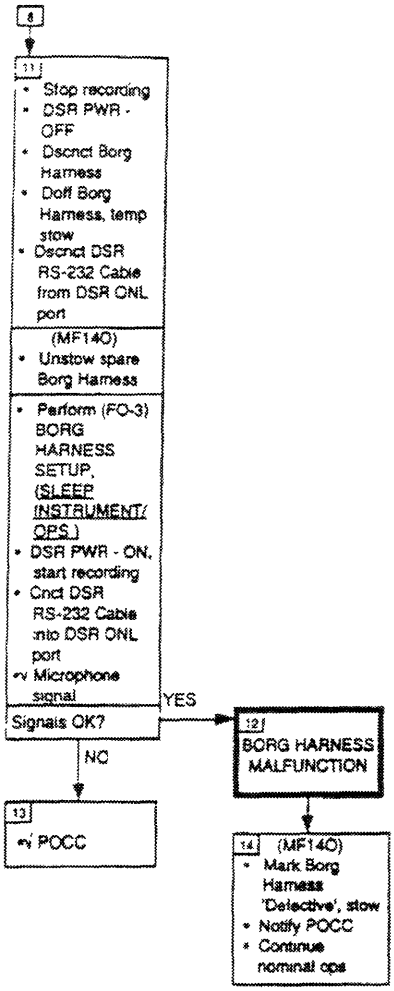
2.2j AIR FLOW SIGNAL NOT PRESENT, POOR QUALITY (CONT'D)

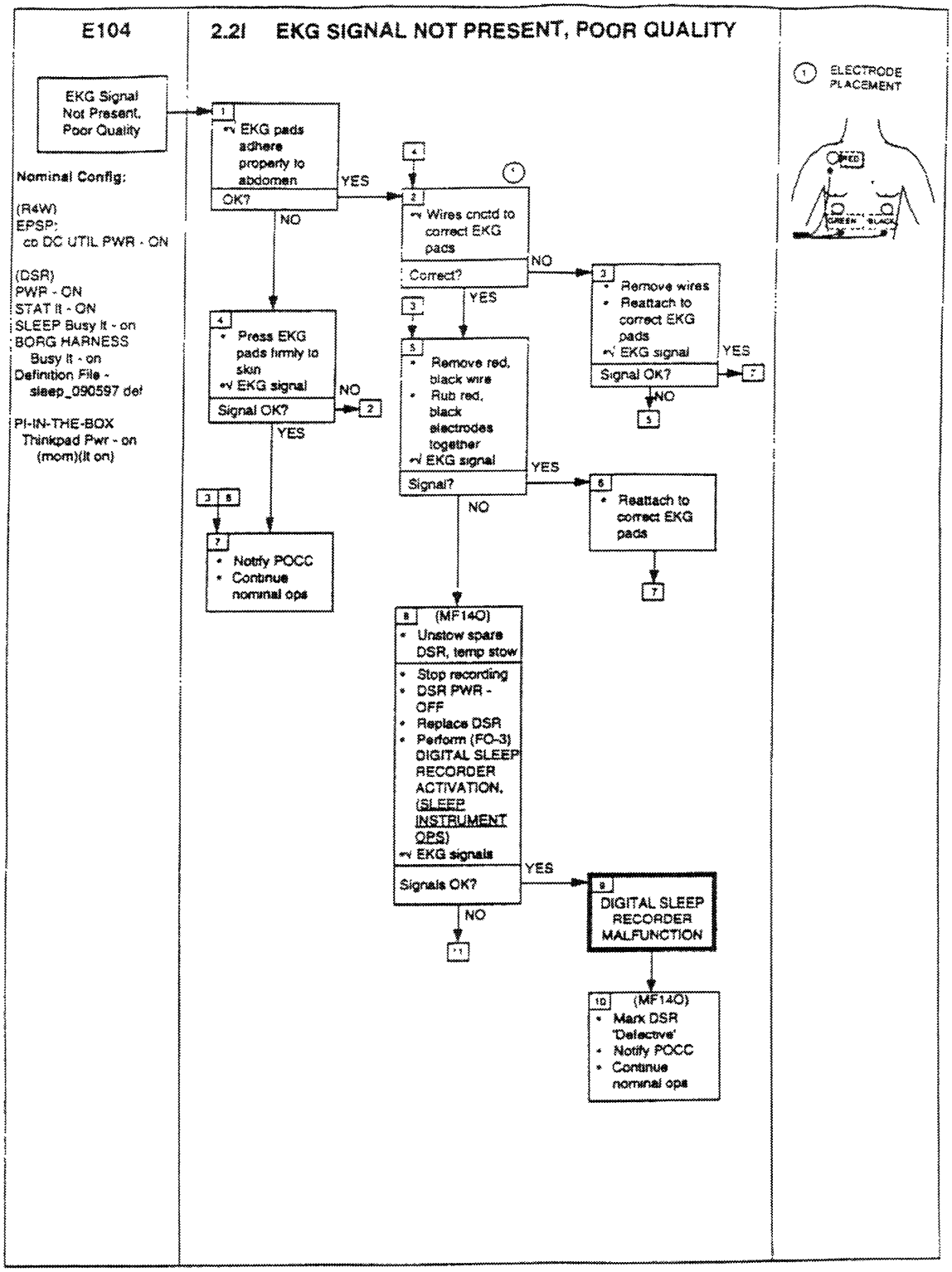



E104
2.2k MICROPHONE SIGNAL NOT PRESENT, POOR QUALITY
Microphone Signal Not Present, Poor Quality
Nominal Config:
(R4W)
EPSP-
cb DC UTIL PWR - ON
(DSR)
PWR - ON
STAT rl - ON
SLEEP Busy lt - on
BORG HARNESS
Busy lt - on
Definition File -
sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on
(mom)(lt on)
1
√ Microphone sensor adhere properly to neck
OK?
NO
YES
2
• Press sensor firmly to skin
• Apply new adhesive if necessary
√ Microphone signal
Signals OK?
YES
NO
6
3
• Continue nominal ops
2
4
√ Sensor location good
Location OK?
YES
NO
5
• Remove sensor from skin
• Rub sensor on Rip suit
√ Microphone signal
Signals OK?
YES
NO
7
• Press sensor firmly to skin
• Apply more adhesive if necessary
• Notify POCC
• Continue nominal ops
6
• Reapply sensor to better location
√ Microphone signal
Signals OK?
YES
3
NO
5
8 (MF14O)
• Unstow spare DSR, temp stow
• Stop recording
• DSR PWR - OFF
• Replace DSR
• Perform (FO-3) DIGITAL SLEEP RECORDER ACTIVATION, (SLEEP INSTRUMENT (OPS)
√ Microphone signal
Signals OK?
YES
NO
11
9
DIGITAL SLEEP RECORDER MALFUNCTION
10
• Mark DSR 'Defective', stow
• Notify POCC
• Continue nominal ops

E104

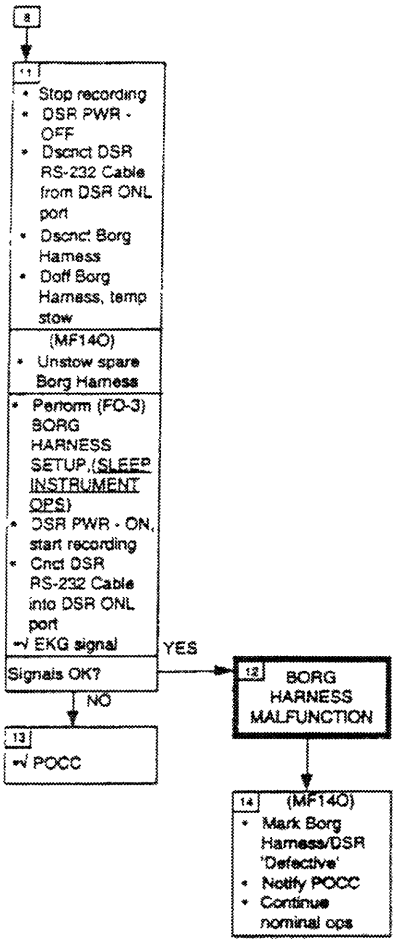
2.2k MICROPHONE SIGNAL NOT PRESENT, POOR QUALITY (CONT'D)

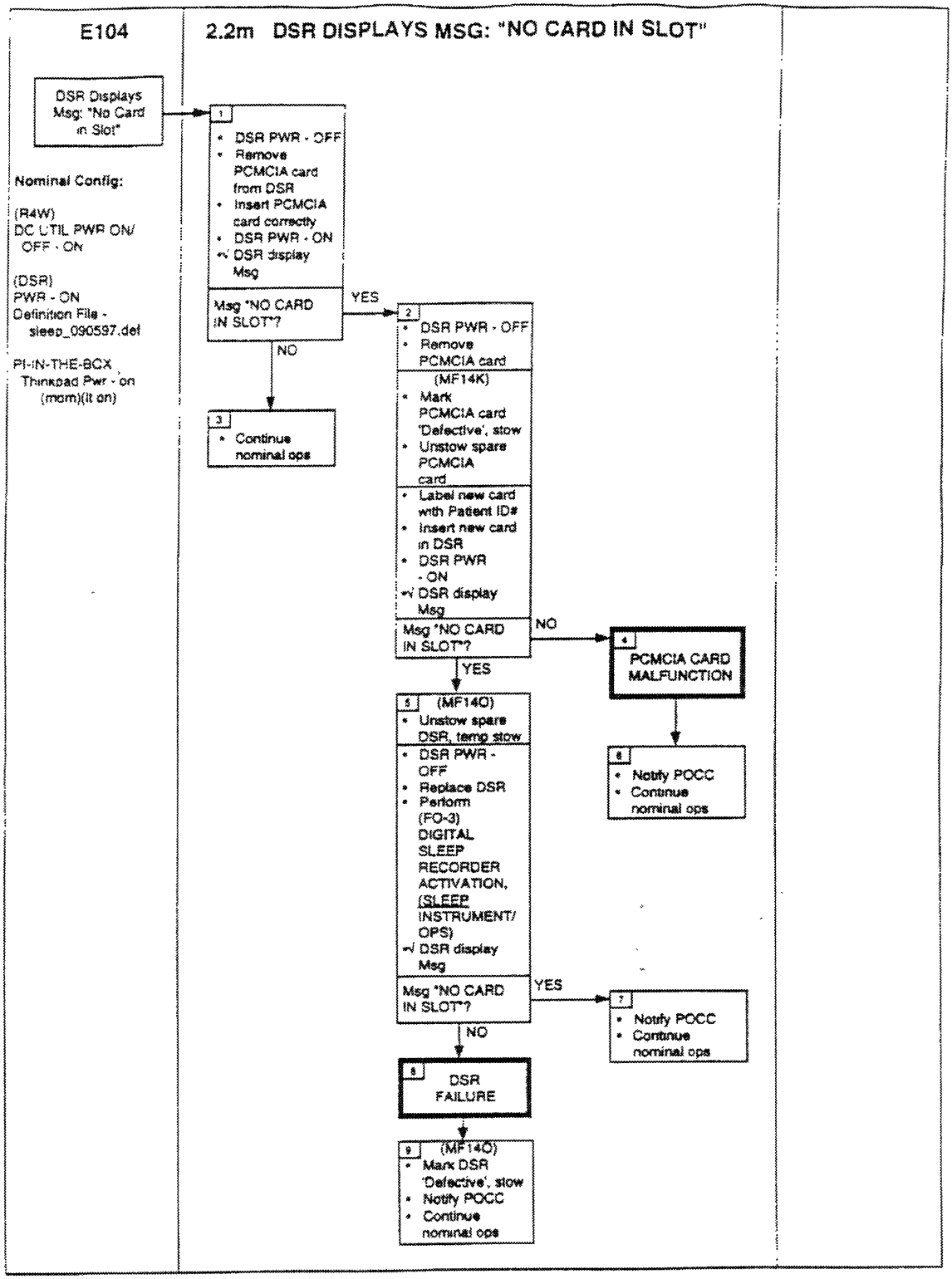


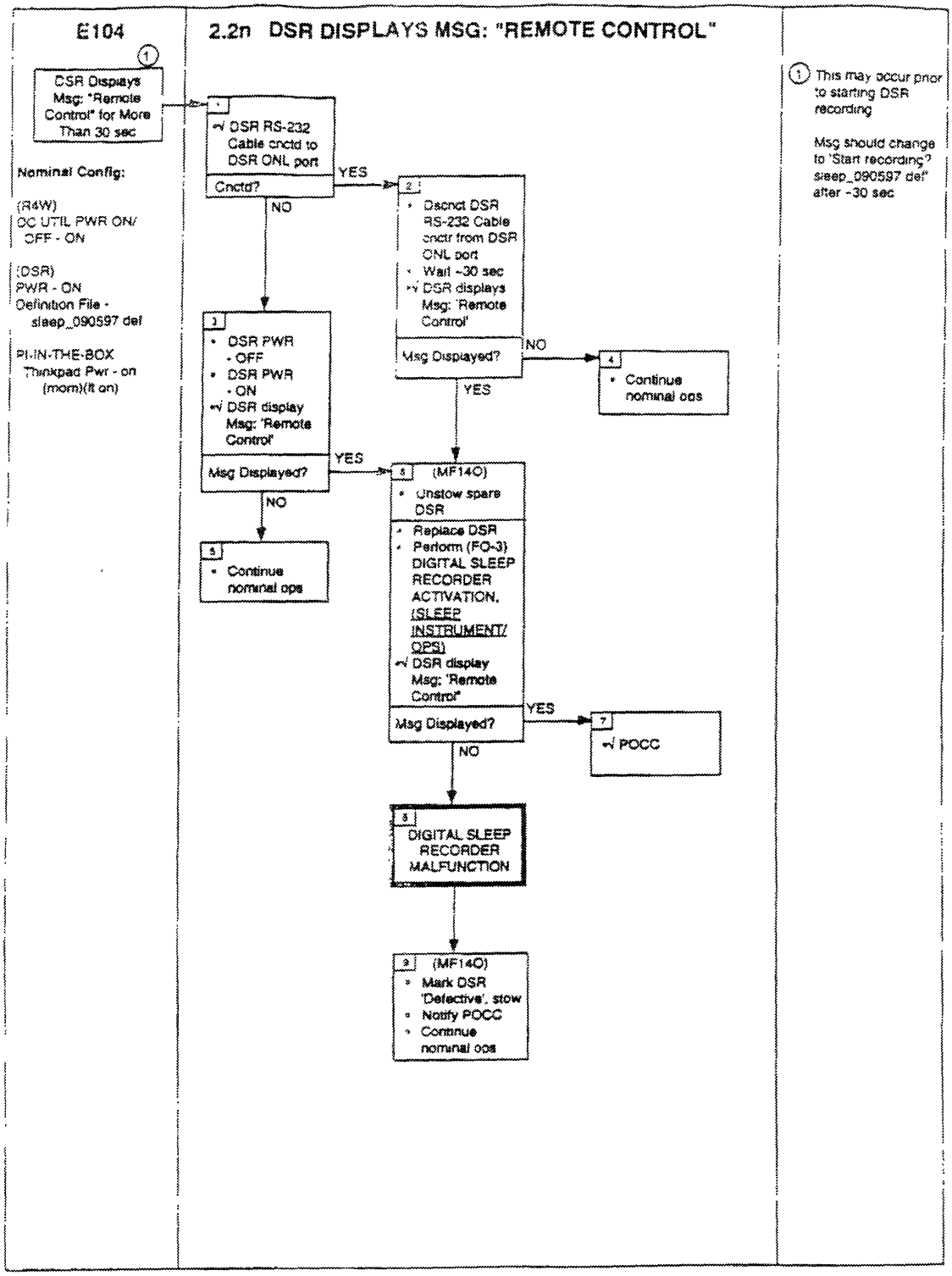

E104
2.2I EKG SIGNAL NOT PRESENT, POOR QUALITY
EKG Signal Not Present, Poor Quality
Nominal Config:
(R4W)
EPSP:
cb DC UTIL PWR - ON
(DSR)
PWR - ON
STAT lt - ON
SLEEP Busy lt - on
BORG HARNESS
Busy lt - on
Definition File -
sleep_090597 def
PI-IN-THE-BOX
Thinkpad Pwr - on
(mom)(lt on)
1
↷ EKG pads adhere properly to abdomen
OK?
YES
NO
2
↷ Wires cnctd to correct EKG pads
Correct?
NO
YES
3
• Remove wires
• Reattach to correct EKG pads
↷ EKG signal
Signal OK?
YES
NO
4
• Press EKG pads firmly to skin
↷ EKG signal
Signal OK?
NO
YES
5
• Remove red, black wire
• Rub red, black electrodes together
↷ EKG signal
Signal?
YES
NO
6
• Reattach to correct EKG pads
7
• Notify POCC
• Continue nominal ops
8 (MF14O)
• Unstow spare DSR, temp stow
• Stop recording
• DSR PWR - OFF
• Replace DSR
• Perform (FO-3) DIGITAL SLEEP RECORDER ACTIVATION, (SLEEP INSTRUMENT OPS)
↷ EKG signals
Signals OK?
YES
NO
9
DIGITAL SLEEP RECORDER MALFUNCTION
10 (MF14O)
• Mark DSR 'Defective'
• Notify POCC
• Continue nominal ops
1 ELECTRODE PLACEMENT
RED
GREEN
BLACK

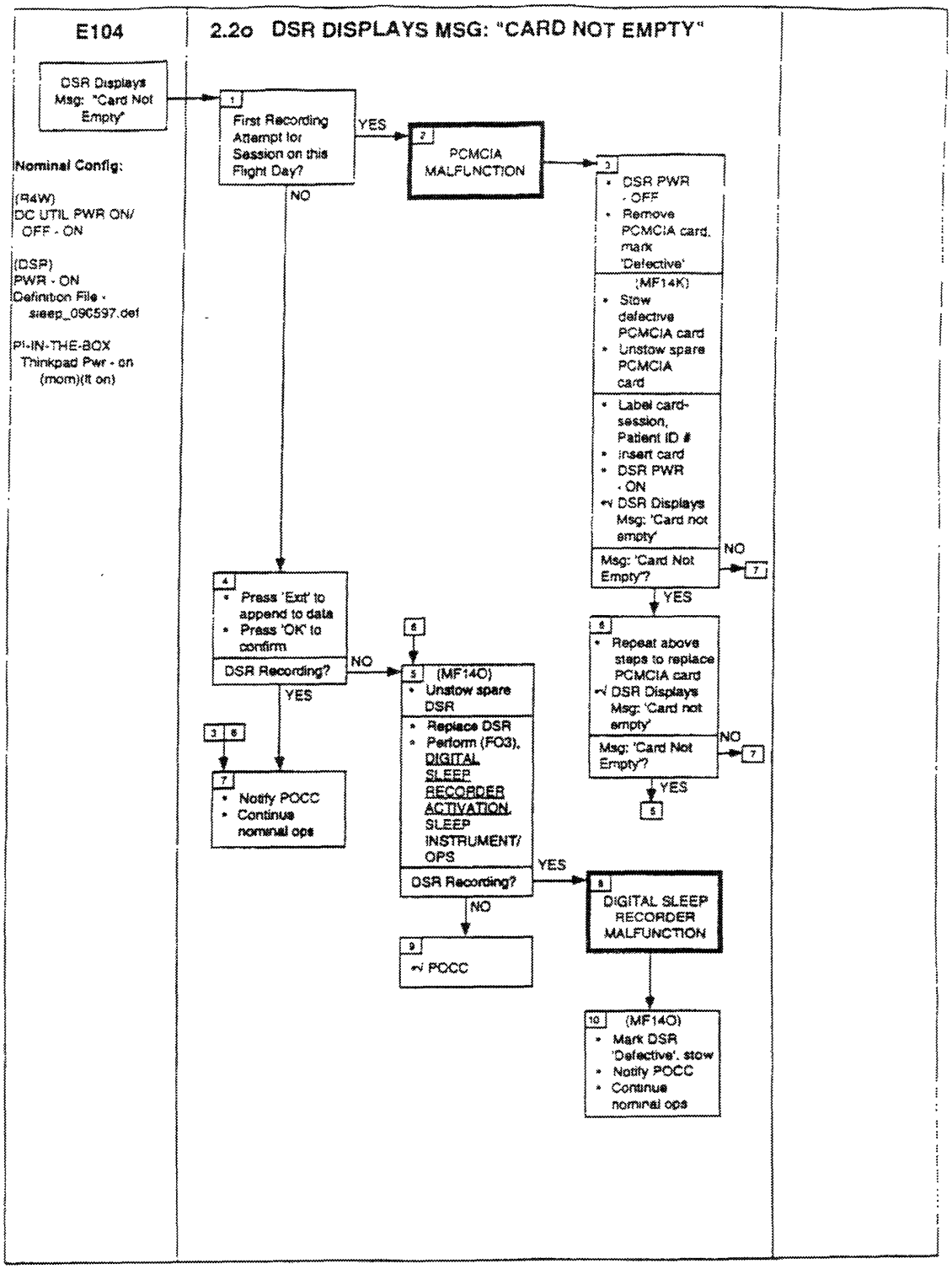
E104

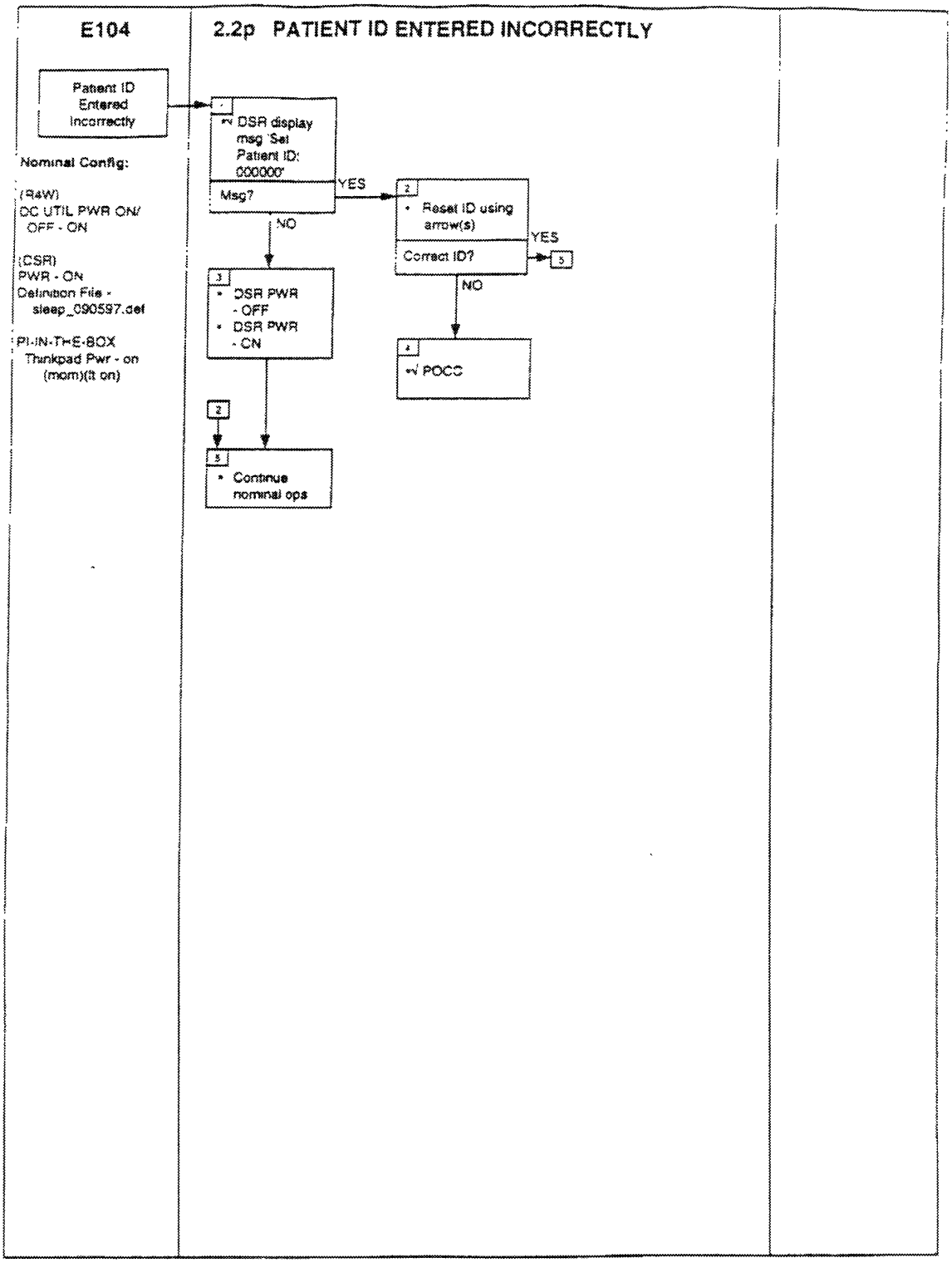
2.2I EKG SIGNAL NOT PRESENT, POOR QUALITY (CONT'D)

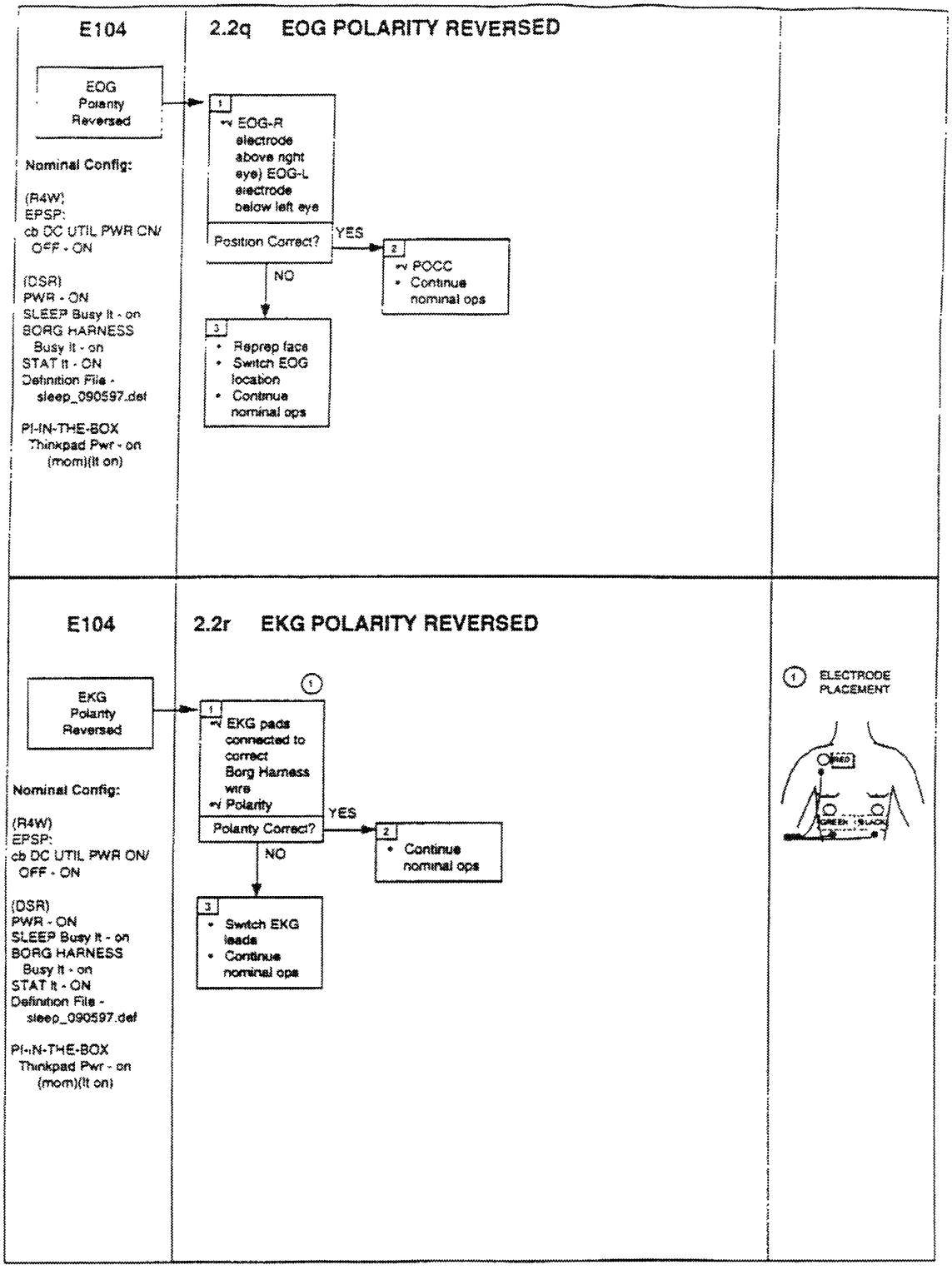


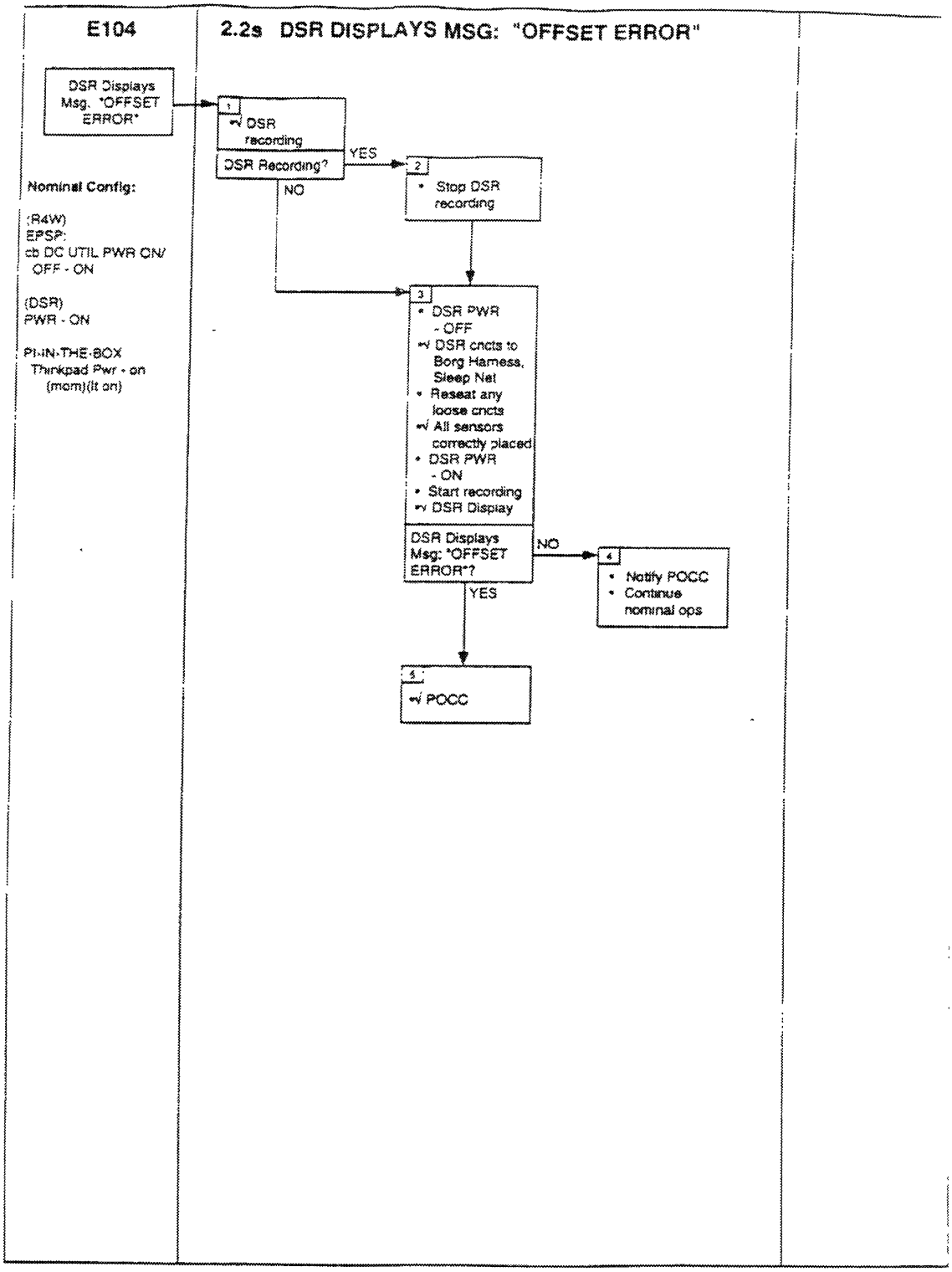

E104
2.2m DSR DISPLAYS MSG: "NO CARD IN SLOT"
DSR Displays Msg: "No Card in Slot"
Nominal Config:
(R4W)
DC UTIL PWR ON/ OFF - ON
(DSR)
PWR - ON
Definition File - sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on (mom)(lit on)
1
• DSR PWR - OFF
• Remove PCMCIA card from DSR
• Insert PCMCIA card correctly
• DSR PWR - ON
√ DSR display Msg
Msg "NO CARD IN SLOT"?
YES
NO
2
• DSR PWR - OFF
• Remove PCMCIA card
(MF14K)
• Mark PCMCIA card 'Defective', stow
• Unstow spare PCMCIA card
• Label new card with Patient ID#
• Insert new card in DSR
• DSR PWR - ON
√ DSR display Msg
Msg "NO CARD IN SLOT"?
NO
YES
3
• Continue nominal ops
4
PCMCIA CARD MALFUNCTION
6
• Notify POCC
• Continue nominal ops
5
(MF14O)
• Unstow spare DSR, temp stow
• DSR PWR - OFF
• Replace DSR
• Perform (FO-3) DIGITAL SLEEP RECORDER ACTIVATION, (SLEEP INSTRUMENT/ OPS)
√ DSR display Msg
Msg "NO CARD IN SLOT"?
YES
NO
7
• Notify POCC
• Continue nominal ops
8
DSR FAILURE
9
(MF14O)
• Mark DSR 'Defective', stow
• Notify POCC
• Continue nominal ops

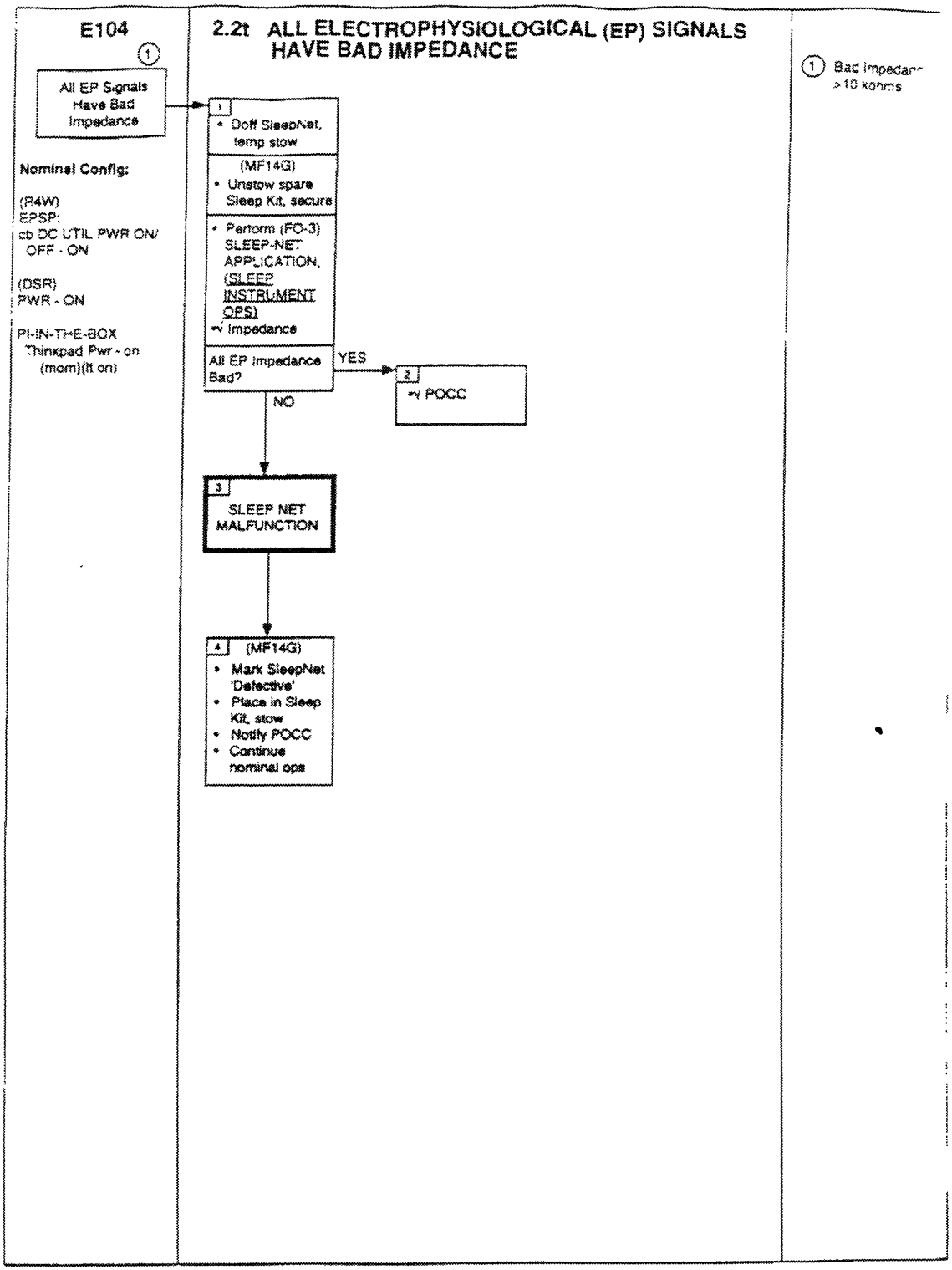

E104
2.2n DSR DISPLAYS MSG: "REMOTE CONTROL"
1
DSR Displays Msg: "Remote Control" for More Than 30 sec
Nominal Config:
(R4W)
OC UTIL PWR ON/ OFF - ON
(DSR)
PWR - ON
Definition File - sleep_090597 def
PI-IN-THE-BOX
Thinkpad Pwr - on (mom)(lt on)
1
√ DSR RS-232 Cable cnctd to DSR ONL port
Cnctd?
YES
NO
2
Dscnct DSR RS-232 Cable cnctr from DSR ONL port
Wait ~30 sec
√ DSR displays Msg: 'Remote Control'
Msg Displayed?
NO
YES
4
Continue nominal ops
3
DSR PWR - OFF
DSR PWR - ON
√ DSR display Msg: 'Remote Control'
Msg Displayed?
YES
NO
5
Continue nominal ops
5
(MF14O)
Unstow spare DSR
Replace DSR
Perform (FO-3) DIGITAL SLEEP RECORDER ACTIVATION, (SLEEP INSTRUMENT/ OPS)
√ DSR display Msg: 'Remote Control'
Msg Displayed?
YES
NO
7
√ POCC
8
DIGITAL SLEEP RECORDER MALFUNCTION
9
(MF14O)
Mark DSR 'Defective', stow
Notify POCC
Continue nominal ops
1 This may occur prior to starting DSR recording
Msg should change to 'Start recording? sleep_090597 def' after ~30 sec


E104
2.2o DSR DISPLAYS MSG: "CARD NOT EMPTY"
DSR Displays Msg: "Card Not Empty"
Nominal Config:
(R4W)
DC UTIL PWR ON/ OFF - ON
(DSP)
PWR - ON
Definition File - sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on (mom)(lt on)
1 First Recording Attempt for Session on this Flight Day?
YES
NO
2 PCMCIA MALFUNCTION
3 • DSR PWR - OFF • Remove PCMCIA card, mark 'Defective'
(MF14K) • Stow defective PCMCIA card • Unstow spare PCMCIA card
• Label card- session, Patient ID # • Insert card • DSR PWR - ON
√ DSR Displays Msg: 'Card not empty'
Msg: 'Card Not Empty'?
NO
7
YES
4 • Press 'Exit' to append to data • Press 'OK' to confirm
DSR Recording?
NO
YES
6
5 (MF14O) • Unstow spare DSR
• Replace DSR • Perform (FO3), DIGITAL SLEEP RECORDER ACTIVATION, SLEEP INSTRUMENT/ OPS
DSR Recording?
YES
NO
8 • Repeat above steps to replace PCMCIA card
√ DSR Displays Msg: 'Card not empty'
Msg: 'Card Not Empty'?
NO
7
YES
8
3 6
7 • Notify POCC • Continue nominal ops
8 DIGITAL SLEEP RECORDER MALFUNCTION
9 √ POCC
10 (MF14O) • Mark DSR 'Defective', stow • Notify POCC • Continue nominal ops


E104
2.2p PATIENT ID ENTERED INCORRECTLY
Patient ID Entered Incorrectly
Nominal Config:
(R4W)
DC UTIL PWR ON/ OFF - ON
(CSR)
PWR - ON
Definition File - sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on (mom)(it on)
1
DSR display msg 'Set Patient ID: 000000'
Msg?
YES
NO
2
Reset ID using arrow(s)
Correct ID?
YES
NO
3
DSR PWR - OFF
DSR PWR - ON
4
POCC
2
3
Continue nominal ops


E104
2.2q EOG POLARITY REVERSED
EOG Polarity Reversed
Nominal Config:
(R4W)
EPSP:
cb DC UTIL PWR ON/ OFF - ON
(DSR)
PWR - ON
SLEEP Busy lt - on
BORG HARNESS Busy lt - on
STAT lt - ON
Definition File - sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on (mom)(lt on)
1
√ EOG-R electrode above right eye) EOG-L electrode below left eye
Position Correct?
YES
2
√ POCC
• Continue nominal ops
NO
3
• Reprep face
• Switch EOG location
• Continue nominal ops
E104
2.2r EKG POLARITY REVERSED
EKG Polarity Reversed
Nominal Config:
(R4W)
EPSP:
cb DC UTIL PWR ON/ OFF - ON
(DSR)
PWR - ON
SLEEP Busy lt - on
BORG HARNESS Busy lt - on
STAT lt - ON
Definition File - sleep_090597.def
PI-IN-THE-BOX
Thinkpad Pwr - on (mom)(lt on)
1
1
√ EKG pads connected to correct Borg Harness wire
√ Polarity
Polarity Correct?
YES
2
• Continue nominal ops
NO
3
• Switch EKG leads
• Continue nominal ops
1 ELECTRODE PLACEMENT
RED
GREEN
BLACK


E104
2.2s DSR DISPLAYS MSG: "OFFSET ERROR"
DSR Displays Msg. "OFFSET ERROR"
Nominal Config:
(R4W)
EPSP:
cb DC UTIL PWR ON/ OFF - ON
(DSR)
PWR - ON
PI-IN-THE-BOX
Thinkpad Pwr - on (mom)(lt on)
1
√ DSR recording
DSR Recording?
YES
NO
2
• Stop DSR recording
3
• DSR PWR - OFF
√ DSR cncts to Borg Harness, Sleep Net
• Reseat any loose cncts
√ All sensors correctly placed
• DSR PWR - ON
• Start recording
√ DSR Display
DSR Displays Msg: "OFFSET ERROR"?
NO
YES
4
• Notify POCC
• Continue nominal ops
5
√ POCC


E104
1
All EP Signals Have Bad Impedance
Nominal Config:
(R4W)
EPSP:
cb DC UTIL PWR ON/ OFF - ON
(DSR)
PWR - ON
PI-IN-THE-BOX
Thinkpad Pwr - on (mom)(lt on)
2.2t ALL ELECTROPHYSIOLOGICAL (EP) SIGNALS HAVE BAD IMPEDANCE
1 Bad Impedan >10 kohms
1
• Doff SleepNet, temp stow
(MF14G)
• Unstow spare Sleep Kit, secure
• Perform (FO-3) SLEEP-NET APPLICATION, (SLEEP INSTRUMENT OPS)
•√ Impedance
All EP Impedance Bad?
YES
2
•√ POCC
NO
3
SLEEP NET MALFUNCTION
4
(MF14G)
• Mark SleepNet 'Defective'
• Place in Sleep Kit, stow
• Notify POCC
• Continue nominal ops

APPENDIX C

[PI] Rules

The rules [PI] uses to evaluate signal presence and quality are contained in the file kb_v300.clp.

```
;;;======================================================

;;;                                                     =

;;;  PI-in-a-Box CLIPS Knowledge Base for the Neurolab  =
;;;  Sleep experiment (instrumentation phase).          =
;;;                                                     =
;;;  Author: Dennis M. Heher                            =
;;;          Caelum Research Corporation                =
;;;          NASA Ames Research Center                  =
;;;          Mail Stop 269-2                            =
;;;          Moffett Field, California 94035-1000       =
;;;                                                     =
;;;======================================================

;;;*****************************************************
;;;*                                                   *
;;;*              DEFTEMPLATE DEFINITIONS              *
;;;*                                                   *
;;;*****************************************************

(deftemplate signal
  (slot label)
  (slot chan)
  (slot present)
  (slot quality)
  (slot stable)
  (slot time)
)

(deftemplate signal_hertz
  (slot chan)
  (slot hertz)
  (slot time)
)

(deftemplate signal_presence
  (slot label)
  (slot variance_threshold)
)

(deftemplate ekg_data
  (slot chan)
```

```
  (slot bps)
  (slot time)
)

(deftemplate pwave_data
  (slot chan)
  (slot bps)
  (slot time)
)

(deftemplate data
  (slot chan)
  (slot val)
  (slot mean)
  (slot adev)
  (slot sdev)
  (slot var)
  (slot skew)
  (slot kurt)
  (slot time)
)

(deftemplate not_present_id
  (slot label)
  (slot key)
  (slot displayed)
)

(deftemplate poor_quality_id
  (slot label)
  (slot key)
  (slot displayed)
)

;;;*********************************************************
;;;*                                                       *
;;;*                        RULES                          *
;;;*                                                       *
;;;*********************************************************

;;;   ***********************************************
;;;   *                                             *
;;;   * Recognize new data and remove the old data.  *
;;;   *                                             *
;;;   ***********************************************

;;; ---------------------------------------------------------------------
(defrule New_Data ""
  (data (chan ?chan) (time ?new_time))
  ?old <- (data (chan ?chan) (time ?time))
  (test (> ?new_time ?time))
  =>
  (retract ?old)
)

;;; ---------------------------------------------------------------------
(defrule New_EKG_Data ""
```

```
   (ekg_data (chan ?chan) (time ?new_time))
   ?old <- (ekg_data (chan ?chan) (time ?time))
   (test (> ?new_time ?time))
   =>
   (retract ?old)
)

;;; ------------------------------------------------------------------
(defrule New_PWave_Data ""
   (pwave_data (chan ?chan) (time ?new_time))
   ?old <- (pwave_data (chan ?chan) (time ?time))
   (test (> ?new_time ?time))
   =>
   (retract ?old)
)

;;; ------------------------------------------------------------------
(defrule New_Hertz_Data ""
   ?sh1 <- (signal_hertz (chan ?chan) (time old))
   ?sh2 <- (signal_hertz (chan ?chan) (time new))
   =>
   (retract ?sh1)
   (modify ?sh2 (time old))
)

;;;   ***********************************************
;;;   *                                             *
;;;   * Check for signal presence.                  *
;;;   *                                             *
;;;   ***********************************************

;;; ------------------------------------------------------------------
;;; If the signal previously was not present and the variance is above
;;;   the threshold, then assert that the signal is present.
;;; ------------------------------------------------------------------
(defrule Signal_Present ""
   ?s <- (signal (label ?label) (chan ?chan) (present unknown|no)
(quality unknown))
   (signal_presence (label ?label) (variance_threshold ?threshold))
   (data (chan ?chan) (var ?var) (time ?time))
   (test (>= ?var ?threshold))
   =>
   (modify ?s (present yes) (time ?time))
)

;;; ------------------------------------------------------------------
(defrule EKG_Signal_Present ""
   ?s <- (signal (label EKG) (chan ?chan) (present unknown|no) (quality
unknown))
   (data (chan ?chan) (sdev ?sdev) (time ?time))
   (ekg_data (chan ?chan) (time ?time))
   (test (>= ?sdev 0.10))
   =>
   (modify ?s (present yes) (time ?time))
)

;;; ------------------------------------------------------------------
```

```
(defrule SaO2_Signal_Present ""
  ?s <- (signal (label SaO2) (chan ?chan) (present unknown|no) (quality
unknown))
  (data (chan ?chan) (val ?value) (time ?time))
  (test (>= ?value 1.0))
  =>
  (modify ?s (present yes) (time ?time))
)

;;; ---------------------------------------------------------------
(defrule PWave_Signal_Present ""
  ?s <- (signal (label PWave) (chan ?chan) (present unknown|no)
(quality unknown))
  (data (chan ?chan) (sdev ?sdev) (time ?time))
  (pwave_data (chan ?chan) (time ?time))
  (test (>= ?sdev 15.00))
  =>
  (modify ?s (present yes) (time ?time))
)

;;; ---------------------------------------------------------------
;;; If the signal was previously not present and the variance is below
;;;   the threshold, then assert that the signal is not present.
;;; ---------------------------------------------------------------
(defrule Signal_Not_Present ""
  ?s <- (signal (label ?label) (chan ?chan) (present unknown|yes))
  (signal_presence (label ?label) (variance_threshold ?threshold))
  (data (chan ?chan) (var ?var) (time ?time))
  (test (< ?var ?threshold))
  =>
  (modify ?s (present no) (quality unknown))
)

;;; ---------------------------------------------------------------
(defrule EKG_Signal_Not_Present ""
  ?s <- (signal (label EKG) (chan ?chan) (present unknown|yes))
  (data (chan ?chan) (sdev ?sdev) (time ?time))
  (ekg_data (chan ?chan) (time ?time))
  (test (< ?sdev 0.10))
  =>
  (modify ?s (present no) (quality unknown))
)

;;; ---------------------------------------------------------------
(defrule SaO2_Signal_Not_Present ""
  ?s <- (signal (label SaO2) (chan ?chan) (present unknown|yes))
  (data (chan ?chan) (val ?value) (time ?time))
  (test (< ?value 1.0))
  =>
  (modify ?s (present no) (quality unknown))
)

;;; ---------------------------------------------------------------
(defrule PWave_Signal_Not_Present ""
  ?s <- (signal (label PWave) (chan ?chan) (present unknown|yes)
(quality unknown))
  (data (chan ?chan) (sdev ?sdev) (time ?time))
```

```
   (pwave_data (chan ?chan) (time ?time))
   (test (< ?sdev 15.00))
   =>
   (modify ?s (present no) (time ?time))
)

;;;   ******************************************************************
;;;   *                                                                *
;;;   * Check for signal stability.                                    *
;;;   *                                                                *
;;;   ******************************************************************

;;; ---------------------------------------------------------------------
(defrule Signal_Stable_1 ""
  ?s <- (signal (label ?label) (chan ?chan) (present yes|unknown)
(quality good|unknown)
                (stable no) (time ?change_time))
  ?npi <- (not_present_id (label ?label) (key ?key) (displayed yes))
   (data (chan ?chan) (time ?time))
   (signal_hertz (chan ?chan) (hertz ?hertz))
   (test (>= ?time (+ ?change_time (* ?hertz 5))))
   =>
   (CLIPS_Clear_Message ?key)
   (modify ?s (stable yes))
   (modify ?npi (displayed no))
)

;;; ---------------------------------------------------------------------
(defrule Signal_Stable_2 ""
  ?s <- (signal (label ?label) (chan ?chan) (present yes|unknown)
(quality good|unknown)
                (stable no) (time ?change_time))
  ?npi <- (poor_quality_id (label ?label) (key ?key) (displayed yes))
   (data (chan ?chan) (time ?time))
   (signal_hertz (chan ?chan) (hertz ?hertz))
   (test (>= ?time (+ ?change_time (* ?hertz 5))))
   =>
   (CLIPS_Clear_Message ?key)
   (modify ?s (stable yes))
   (modify ?npi (displayed no))
)

;;;   ******************************************************************
;;;   *                                                                *
;;;   * EEG (C3, C4, O1, O2) Rules.                                    *
;;;   *                                                                *
;;;   ******************************************************************

;;; ---------------------------------------------------------------------
(defrule EEG_C3_Good_Quality ""
  ?s <- (signal (label C3) (chan ?chan) (present yes) (quality
unknown|bad))
   (data (chan ?chan) (var ?var) (time ?time))
   (test (and (> ?var 100.0)
              (< ?var 4000.0)))
   =>
   (modify ?s (quality good) (time ?time))
```

```
)

;;; ------------------------------------------------------------------
(defrule EEG_C3_Unknown_Quality ""
  ?s <- (signal (label C3) (chan ?chan) (present yes) (quality
good|bad))
  (data (chan ?chan) (var ?var) (time ?time))
  (test (and (>= ?var 4000.0)
             (< ?var 7500.0)))
  =>
  (modify ?s (quality unknown)(time ?time))
)

;;; ------------------------------------------------------------------
(defrule EEG_C3_Bad_Quality ""
  ?s <- (signal (label C3) (chan ?chan) (present yes) (quality
good|unknown))
  (data (chan ?chan) (var ?var))
  (test (>= ?var 7500.0))
  =>
  (modify ?s (quality bad))
)

;;; ------------------------------------------------------------------
(defrule EEG_O1_Good_Quality ""
  ?s <- (signal (label O1) (chan ?chan) (present yes) (quality
unknown|bad))
  (data (chan ?chan) (var ?var) (time ?time))
  (test (and (> ?var 100.0)
             (< ?var 4000.0)))
  =>
  (modify ?s (quality good) (time ?time))
)

;;; ------------------------------------------------------------------
(defrule EEG_O1_Unknown_Quality ""
  ?s <- (signal (label O1) (chan ?chan) (present yes) (quality
good|bad))
  (data (chan ?chan) (var ?var) (time ?time))
  (test (and (>= ?var 4000.0)
             (< ?var 7500.0)))
  =>
  (modify ?s (quality unknown)(time ?time))
)

;;; ------------------------------------------------------------------
(defrule EEG_O1_Bad_Quality ""
  ?s <- (signal (label O1) (chan ?chan) (present yes) (quality
good|unknown))
  (data (chan ?chan) (var ?var))
  (test (>= ?var 7500.0))
  =>
  (modify ?s (quality bad))
)

;;; ------------------------------------------------------------------
(defrule EEG_C4_Good_Quality ""
```

```
  ?s <- (signal (label C4) (chan ?chan) (present yes) (quality
unknown|bad))
  (data (chan ?chan) (var ?var) (time ?time))
  (test (and (> ?var 100.0)
             (< ?var 4000.0)))
  =>
  (modify ?s (quality good)(time ?time))
)

;;; ---------------------------------------------------------------------
(defrule EEG_C4_Unknown_Quality ""
  ?s <- (signal (label C4) (chan ?chan) (present yes) (quality
good|bad))
  (data (chan ?chan) (var ?var) (time ?time))
  (test (and (>= ?var 4000.0)
             (< ?var 7500.0)))
  =>
  (modify ?s (quality unknown)(time ?time))
)

;;; ---------------------------------------------------------------------
(defrule EEG_C4_Bad_Quality ""
  ?s <- (signal (label C4) (chan ?chan) (present yes) (quality
good|unknown))
  (data (chan ?chan) (var ?var))
  (test (>= ?var 7500.0))
  =>
  (modify ?s (quality bad))
)

;;; ---------------------------------------------------------------------
(defrule EEG_O2_Good_Quality ""
  ?s <- (signal (label O2) (chan ?chan) (present yes) (quality
unknown|bad))
  (data (chan ?chan) (var ?var) (time ?time))
  (test (and (> ?var 100.0)
             (< ?var 4000.0)))
  =>
  (modify ?s (quality good)(time ?time))
)

;;; ---------------------------------------------------------------------
(defrule EEG_O2_Unknown_Quality ""
  ?s <- (signal (label O2) (chan ?chan) (present yes) (quality
good|bad))
  (data (chan ?chan) (var ?var) (time ?time))
  (test (and (>= ?var 4000.0)
             (< ?var 7500.0)))
  =>
  (modify ?s (quality unknown)(time ?time))
)

;;; ---------------------------------------------------------------------
(defrule EEG_O2_Bad_Quality ""
  ?s <- (signal (label O2) (chan ?chan) (present yes) (quality
good|unknown))
  (data (chan ?chan) (var ?var))
```

```
  (test (>= ?var 7500.0))
  =>
  (modify ?s (quality bad))
)

;;;   ***********************************************
;;;   *                                             *
;;;   * EOG (EOG_L, EOG_R) Rules.                   *
;;;   *                                             *
;;;   ***********************************************

;;; ---------------------------------------------------------------------
(defrule EOG_L_Good_Quality ""
  ?s <- (signal (label EOG_L) (chan ?chan) (present yes) (quality
unknown|bad))
  (data (chan ?chan) (mean ?mean) (var ?var) (time ?time))
  (test (and (>= ?mean -100.0)
             (<= ?mean 100.0)
             (>= ?var 30.0)))
  =>
  (modify ?s (quality good)(time ?time))
)

;;; ---------------------------------------------------------------------
(defrule EOG_R_Good_Quality ""
  ?s <- (signal (label EOG_R) (chan ?chan) (present yes) (quality
unknown|bad))
  (data (chan ?chan) (mean ?mean) (var ?var) (time ?time))
  (test (and (>= ?mean -100.0)
             (<= ?mean 100.0)
             (>= ?var 30.0)))
  =>
  (modify ?s (quality good)(time ?time))
)

;;; ---------------------------------------------------------------------
(defrule EOG_L_Bad_Quality ""
  ?s <- (signal (label EOG_L) (chan ?chan) (present yes) (quality
good|unknown))
  (data (chan ?chan) (mean ?mean))
  (test (or (< ?mean -100.0)
            (> ?mean 100.0)
            ))
  =>
  (modify ?s (quality bad))
)

;;; ---------------------------------------------------------------------
(defrule EOG_R_Bad_Quality ""
  ?s <- (signal (label EOG_R) (chan ?chan) (present yes) (quality
good|unknown))
  (data (chan ?chan) (mean ?mean))
  (test (or (< ?mean -100.0)
            (> ?mean 100.0)
            ))
  =>
  (modify ?s (quality bad))
```

```
)

;;; ------------------------------------------------------------------
(defrule EOG_L_Uknown_Quality ""
  ?s <- (signal (label EOG_L) (chan ?chan) (present yes) (quality
good|bad))
  (data (chan ?chan) (mean ?mean) (var ?var) (time ?time))
  (test (and (>= ?mean -100.0)
             (<= ?mean 100.0)
             (< ?var 30.0)))
  =>
  (modify ?s (quality unknown)(time ?time))
)

;;; ------------------------------------------------------------------
(defrule EOG_R_Unknown_Quality ""
  ?s <- (signal (label EOG_R) (chan ?chan) (present yes) (quality
good|bad))
  (data (chan ?chan) (mean ?mean) (var ?var) (time ?time))
  (test (and (>= ?mean -100.0)
             (<= ?mean 100.0)
             (< ?var 30.0)))
  =>
  (modify ?s (quality unknown)(time ?time))
)

;;;   ***********************************************
;;;   *                                             *
;;;   * EMG (EMG_L, EMG_R) Rules.                   *
;;;   *                                             *
;;;   ***********************************************

;;; ------------------------------------------------------------------
(defrule EMG_L_Good_Quality ""
  ?s <- (signal (label EMG_L) (chan ?chan) (present yes) (quality
unknown|bad))
  (data (chan ?chan) (val ?value) (mean ?mean) (adev ?adev) (sdev
?sdev)
        (var ?var) (skew ?skew) (kurt ?kurt) (time ?time))
  =>
  (modify ?s (quality good) (time ?time))
)

;;; ------------------------------------------------------------------
(defrule EMG_R_Good_Quality ""
  ?s <- (signal (label EMG_R) (chan ?chan) (present yes) (quality
unknown|bad))
  (data (chan ?chan) (val ?value) (mean ?mean) (adev ?adev) (sdev
?sdev)
        (var ?var) (skew ?skew) (kurt ?kurt) (time ?time))
  =>
  (modify ?s (quality good)(time ?time))
)

;;; ------------------------------------------------------------------
(defrule EMG_L_Unknown_Quality ""
  (DONT_USE_THIS_RULE)
```

```
  ?s <- (signal (label EMG_L) (chan ?chan) (present yes) (quality
good|bad))
  (data (chan ?chan) (val ?value) (mean ?mean) (adev ?adev) (sdev
?sdev)
        (var ?var) (skew ?skew) (kurt ?kurt) (time ?time))
  =>
  (modify ?s (quality unknown)(time ?time))
)

;;; ------------------------------------------------------------------
(defrule EMG_R_Unknown_Quality ""
  (DONT_USE_THIS_RULE)
  ?s <- (signal (label EMG_R) (chan ?chan) (present yes) (quality
good|bad))
  (data (chan ?chan) (val ?value) (mean ?mean) (adev ?adev) (sdev
?sdev)
        (var ?var) (skew ?skew) (kurt ?kurt) (time ?time))
  =>
  (modify ?s (quality unknown)(time ?time))
)

;;; ------------------------------------------------------------------
(defrule EMG_L_Bad_Quality ""
  (DONT_USE_THIS_RULE)
  ?s <- (signal (label EMG_L) (chan ?chan) (present yes) (quality
unknown|good))
  (data (chan ?chan) (val ?value) (mean ?mean) (adev ?adev) (sdev
?sdev)
        (var ?var) (skew ?skew) (kurt ?kurt) (time ?time))
  =>
  (modify ?s (quality bad))
)

;;; ------------------------------------------------------------------
(defrule EMG_R_Bad_Quality ""
  (DONT_USE_THIS_RULE)
  ?s <- (signal (label EMG_R) (chan ?chan) (present yes) (quality
unknown|good))
  (data (chan ?chan) (val ?value) (mean ?mean) (adev ?adev) (sdev
?sdev)
        (var ?var) (skew ?skew) (kurt ?kurt) (time ?time))
  =>
  (modify ?s (quality bad))
)

;;;   ***********************************************
;;;   *                                             *
;;;   * EKG Rules.                                  *
;;;   *                                             *
;;;   ***********************************************

;;; ------------------------------------------------------------------
(defrule EKG_Good_Quality ""
  ?s <- (signal (label EKG) (chan ?chan) (present yes) (quality
unknown|bad))
  (ekg_data (chan ?chan) (bps ?bps) (time ?time))
  (data (chan ?chan) (sdev ?sdev) (time ?time))
```

```
  (test (<= ?sdev 0.5))
  (test (and (>= ?bps 1.0)
             (<= ?bps 3.6)))
  =>
  (modify ?s (quality good) (time ?time))
)

;;; ---------------------------------------------------------------------
(defrule EKG_Good_Quality_2 ""
  ?s <- (signal (label EKG) (chan ?chan) (present yes) (quality
unknown|bad))
  (ekg_data (chan ?chan) (bps ?bps) (time ?time))
  (data (chan ?chan) (sdev ?sdev) (time ?time))
  (test (> ?sdev 0.5))
  (test (<= ?sdev 0.85))
  (test (and (>= ?bps 1.0)
             (<= ?bps 1.8)))
  =>
  (modify ?s (quality good) (time ?time))
)

;;; ---------------------------------------------------------------------
(defrule EKG_Unknown_Quality ""
  ?s <- (signal (label EKG) (chan ?chan) (present yes) (quality
good|bad))
  (ekg_data (chan ?chan) (bps ?bps) (time ?time))
  (data (chan ?chan) (sdev ?sdev) (time ?time))
  (test (<= ?sdev 0.5))
  (test (or (and (>= ?bps 0.75)
                 (< ?bps 1.0))
            (and (> ?bps 3.6)
                 (<= ?bps 5.0))))
  =>
  (modify ?s (quality unknown) (time ?time))
)

;;; ---------------------------------------------------------------------
(defrule EKG_Unknown_Quality_2 ""
  ?s <- (signal (label EKG) (chan ?chan) (present yes) (quality
good|bad))
  (ekg_data (chan ?chan) (bps ?bps) (time ?time))
  (data (chan ?chan) (sdev ?sdev) (time ?time))
  (test (> ?sdev 0.5))
  (test (<= ?sdev 0.85))
  (test (or (and (>= ?bps 0.75)
                 (< ?bps 1.0))
            (and (> ?bps 1.8)
                 (<= ?bps 2.5))))
  =>
  (modify ?s (quality unknown) (time ?time))
)

;;; ---------------------------------------------------------------------
(defrule EKG_Bad_Quality ""
  ?s <- (signal (label EKG) (chan ?chan) (present yes) (quality
good|unknown))
  (ekg_data (chan ?chan) (bps ?bps) (time ?time))
```

```
  (data (chan ?chan) (sdev ?sdev) (time ?time))
  (test (<= ?sdev 0.5))
  (test (or (< ?bps 0.75)
            (> ?bps 5.0)))
  =>
  (modify ?s (quality bad))
)

;;; ------------------------------------------------------------------
(defrule EKG_Bad_Quality_2 ""
  ?s <- (signal (label EKG) (chan ?chan) (present yes) (quality
good|unknown))
  (ekg_data (chan ?chan) (bps ?bps) (time ?time))
  (data (chan ?chan) (sdev ?sdev) (time ?time))
  (test (> ?sdev 0.5))
  (test (<= ?sdev 0.85))
  (test (or (< ?bps 0.75)
            (> ?bps 2.5)))
  =>
  (modify ?s (quality bad))
)

;;; ------------------------------------------------------------------
(defrule EKG_Bad_Quality_3 ""
  ?s <- (signal (label EKG) (chan ?chan) (present yes) (quality
good|unknown))
  (ekg_data (chan ?chan) (bps ?bps) (time ?time))
  (data (chan ?chan) (sdev ?sdev) (time ?time))
  (test (> ?sdev 0.85))
  =>
  (modify ?s (quality bad))
)

;;;   ***********************************************
;;;   *                                             *
;;;   * SaO2 Quality Rules.                         *
;;;   *                                             *
;;;   ***********************************************

;;; ------------------------------------------------------------------
(defrule SaO2_Good_Quality ""
  ?s <- (signal (label SaO2) (chan ?chan) (present yes) (quality
unknown|bad))
  (data (chan ?chan) (val ?value) (time ?time))
  (test (and (>= ?value 95.0)
             (<= ?value 100.0)))
  =>
  (modify ?s (quality good) (time ?time))
)

;;; ------------------------------------------------------------------
(defrule SaO2_Bad_Quality ""
  ?s <- (signal (label SaO2) (chan ?chan) (present yes) (quality
unknown|good))
  (data (chan ?chan) (val ?value))
  (test (or (< ?value 95.0)
            (> ?value 100.0)))
```

```
  =>
  (modify ?s (quality bad))
)

;;;   ***********************************************
;;;   *                                             *
;;;   * PWave Rules.                                *
;;;   *                                             *
;;;   ***********************************************

;;; ---------------------------------------------------------------------
(defrule PWave_Good_Quality ""
  ?s <- (signal (label PWave) (chan ?chan) (present yes) (quality
unknown|bad))
  (pwave_data (chan ?chan) (bps ?bps) (time ?time))
  (data (chan ?chan) (sdev ?sdev) (time ?time))
  (test (and (>= ?bps 1.0)
             (<= ?bps 1.8)))
  =>
  (modify ?s (quality good) (time ?time))
)

;;; ---------------------------------------------------------------------
(defrule PWave_Unknown_Quality ""
  ?s <- (signal (label PWave) (chan ?chan) (present yes) (quality
good|bad))
  (pwave_data (chan ?chan) (bps ?bps) (time ?time))
  (data (chan ?chan) (sdev ?sdev) (time ?time))
  (test (or (and (>= ?bps 0.75)
                 (< ?bps 1.0))
            (and (> ?bps 1.8)
                 (<= ?bps 2.5))))
  =>
  (modify ?s (quality unknown) (time ?time))
)

;;; ---------------------------------------------------------------------
(defrule PWave_Bad_Quality ""
  ?s <- (signal (label PWave) (chan ?chan) (present yes) (quality
good|unknown))
  (pwave_data (chan ?chan) (bps ?bps) (time ?time))
  (data (chan ?chan) (sdev ?sdev) (time ?time))
  (test (or (< ?bps 0.75)
            (> ?bps 2.5)))
  =>
  (modify ?s (quality bad))
)

;;;   ***********************************************
;;;   *                                             *
;;;   * AirFlow Rules.                              *
;;;   *                                             *
;;;   ***********************************************

;;; ---------------------------------------------------------------------
(defrule Flow_Good_Quality ""
```

```
  ?s <- (signal (label Flow) (chan ?chan) (present yes) (quality
unknown|bad))
  (data (chan ?chan) (adev ?adev) (time ?time))
  (test (and (>= ?adev 5.0)
             (<= ?adev 60.0)))
  =>
  (modify ?s (quality good) (time ?time))
)

;;; ------------------------------------------------------------------
(defrule Flow_Unknown_Quality ""
  ?s <- (signal (label Flow) (chan ?chan) (present yes) (quality
good|bad))
  (data (chan ?chan) (adev ?adev) (time ?time))
  (test (and (> ?adev 0.5)
             (< ?adev 5.0)))
  =>
  (modify ?s (quality unknown)(time ?time))
)

;;; ------------------------------------------------------------------
(defrule Flow_Bad_Quality ""
  ?s <- (signal (label Flow) (chan ?chan) (present yes) (quality
unknown|good))
  (data (chan ?chan) (adev ?adev))
  (test (or (< ?adev 0.5)
            (> ?adev 60.0)))
  =>
  (modify ?s (quality bad))
)

;;;   ***********************************************
;;;   *                                             *
;;;   * Microphone Rules.                           *
;;;   *                                             *
;;;   ***********************************************

;;; ------------------------------------------------------------------
(defrule Mic_Good_Quality ""
  ?s <- (signal (label Mic) (chan ?chan) (present unknown) (quality
unknown))
  (data (chan ?chan) (adev ?adev) (time ?time))
  (test (>= ?adev 0.5))
  =>
  (modify ?s (present yes) (quality good) (time ?time))
)

;;; ------------------------------------------------------------------
(defrule Mic_Unknown_Quality ""
  ?s <- (signal (label Mic) (chan ?chan) (present yes) (quality good))
  (data (chan ?chan) (adev ?adev) (time ?time))
  (test (< ?adev 0.5))
  =>
  (modify ?s (present unknown) (quality unknown)(time ?time))
)

;;;   ***********************************************
```

```
;;;   *                                                  *
;;;   * RIP (RIP_AB, RIP_RC) Rules.                      *
;;;   *                                                  *
;;;   ****************************************************

;;; ---------------------------------------------------------------------
(defrule RIP_AB_Good_Quality ""
  ?s <- (signal (label RIP_AB) (chan ?chan) (present yes) (quality
unknown|bad))
  (data (chan ?chan) (adev ?adev) (time ?time))
  (test (>= ?adev 1.0))
  =>
  (modify ?s (quality good) (time ?time))
)

;;; ---------------------------------------------------------------------
(defrule RIP_RC_Good_Quality ""
  ?s <- (signal (label RIP_RC) (chan ?chan) (present yes) (quality
unknown|bad))
  (data (chan ?chan) (adev ?adev) (time ?time))
  (test (>= ?adev 1.0))
  =>
  (modify ?s (quality good) (time ?time))
)

;;; ---------------------------------------------------------------------
(defrule RIP_AB_Unknown_Quality ""
  ?s <- (signal (label RIP_AB) (chan ?chan) (present yes) (quality
good))
  (data (chan ?chan) (adev ?adev) (time ?time))
  (test (< ?adev 1.0))
  =>
  (modify ?s (quality unknown) (time ?time))
)

;;; ---------------------------------------------------------------------
(defrule RIP_RC_Unknown_Quality ""
  ?s <- (signal (label RIP_RC) (chan ?chan) (present yes) (quality
good))
  (data (chan ?chan) (adev ?adev) (time ?time))
  (test (< ?adev 1.0))
  =>
  (modify ?s (quality unknown) (time ?time))
)

;;;   ************************************************
;;;   *                                              *
;;;   * Event Marker Rules.                          *
;;;   *                                              *
;;;   ************************************************

;;; ---------------------------------------------------------------------
(defrule Event_Marker_Present ""
  ?s <- (signal (label MRK) (chan ?chan) (present unknown) (quality
unknown))
  (data (chan ?chan) (val ?value) (time ?time))
  (test (= ?value 32.0))
```

```
  =>
  (modify ?s (present yes) (quality good) (time ?time))
)

;;; ------------------------------------------------------------------
(defrule Event_Marker_Not_Present ""
  ?s <- (signal (label MRK) (chan ?chan) (present yes) (quality good))
  (data (chan ?chan) (val ?value) (time ?time))
  (test (neq ?value 32.0))
  =>
  (modify ?s (present unknown) (quality unknown) (time ?time))
)

;;;   ***********************************************
;;;   *                                             *
;;;   * Signal Presence Rules.                      *
;;;   *                                             *
;;;   ***********************************************

;;; ------------------------------------------------------------------
(defrule All_Present ""
  ?npi <- (not_present_id (label All_Not_Present) (key ?key) (displayed
yes))
;  (signal (label
C3|O1|C4|O2|EOG_L|EOG_R|EMG_L|EMG_R|Flow|Mic|EKG|SaO2|PWave|RIP_AB|RIP_
RC)
;          (present yes))
  (signal (label C3|O1|C4|O2|EOG_L|EOG_R|EKG|SaO2|RIP_AB|RIP_RC)
          (present yes))
  =>
  (modify ?npi (displayed no))
  (CLIPS_Clear_Message ?key)
)

;;; ------------------------------------------------------------------
(defrule Head_Present ""
  ?npi <- (not_present_id (label EP_Flow_Mic_Not_Present) (key ?key)
(displayed yes))
;  (signal (label C3|O1|C4|O2|EOG_L|EOG_R|EMG_L|EMG_R|Flow|Mic)
(present yes))
  (signal (label C3|O1|C4|O2|EOG_L|EOG_R|Flow|Mic) (present yes))
  =>
  (modify ?npi (displayed no))
  (CLIPS_Clear_Message ?key)
)

;;; ------------------------------------------------------------------
(defrule EP_Present ""
  ?npi <- (not_present_id (label EP_Not_Present) (key ?key) (displayed
yes))
;  (signal  (label C3|O1|C4|O2|EOG_L|EOG_R|EMG_L|EMG_R) (present yes))
  (signal  (label C3|O1|C4|O2|EOG_L|EOG_R) (present yes))
  =>
  (modify ?npi (displayed no))
  (CLIPS_Clear_Message ?key)
)
```

```
;;; ---------------------------------------------------------------------
(defrule CR_Present ""
  ?npi <- (not_present_id (label CR_Not_Present) (key ?key) (displayed
yes))
;  (signal (label EKG|SaO2|PWave|Flow|Mic|RIP_AB|RIP_RC) (present yes))
  (signal (label EKG|SaO2|RIP_AB|RIP_RC) (present yes))
  =>
  (modify ?npi (displayed no))
  (CLIPS_Clear_Message ?key)
)

;;; ---------------------------------------------------------------------
(defrule RIP_Present ""
  ?npi <- (not_present_id (label RIP_Not_Present) (key ?key) (displayed
yes))
  (signal (label RIP_AB|RIP_RC) (present yes))
  =>
  (modify ?npi (displayed no))
  (CLIPS_Clear_Message ?key)
)

;;; ---------------------------------------------------------------------
(defrule Channel_Unknown_Present ""
  (signal (label ?label) (chan ?chan) (present unknown) (quality
unknown))
  (not_present_id (label ?label) (displayed no|none))
  =>
  (CLIPS_Unknown_State ?chan)
)

;;;   ***********************************************
;;;   *                                             *
;;;   * Signal Not Present Rules.                   *
;;;   *                                             *
;;;   ***********************************************

;;; ---------------------------------------------------------------------
(defrule All_Not_Present ""
  (full_buffer)
  ?npi <- (not_present_id (label All_Not_Present) (key ?key) (displayed
no))
  ?s1 <- (signal (label C3) (chan ?chan1) (present no|unknown) (quality
unknown))
  ?s2 <- (signal (label O1) (chan ?chan2) (present no|unknown) (quality
unknown))
  ?s3 <- (signal (label C4) (chan ?chan3) (present no|unknown) (quality
unknown))
  ?s4 <- (signal (label O2) (chan ?chan4)  (present no|unknown)
(quality unknown))
  ?s5 <- (signal (label EOG_L) (chan ?chan5) (present no|unknown)
(quality unknown))
  ?s6 <- (signal (label EOG_R) (chan ?chan6) (present no|unknown)
(quality unknown))
  ?s7 <- (signal (label EMG_L) (chan ?chan7) (present ?p7) (quality
?q7))
  ?s8 <- (signal (label EMG_R) (chan ?chan8) (present ?p8) (quality
?q8))
```

```
  ?s9 <- (signal (label EKG) (chan ?chan9) (present no|unknown)
(quality unknown))
  ?s10 <- (signal (label SaO2) (chan ?chan10) (present no|unknown)
(quality unknown))
  ?s11 <- (signal (label PWave) (chan ?chan11) (present ?p11) (quality
?q11))
  ?s12 <- (signal (label Flow) (chan ?chan12) (present no|unknown)
(quality unknown))
  ?s13 <- (signal (label Mic) (chan ?chan13) (present no|unknown)
(quality unknown))
  ?s14 <- (signal (label RIP_AB) (chan ?chan14) (present no|unknown)
(quality unknown))
  ?s15 <- (signal (label RIP_RC) (chan ?chan15)  (present no|unknown)
(quality unknown))
  ?npi1 <- (not_present_id (label C3) (key ?key1))
  ?npi2 <- (not_present_id (label O1) (key ?key2))
  ?npi3 <- (not_present_id (label C4) (key ?key3))
  ?npi4 <- (not_present_id (label O2) (key ?key4))
  ?npi5 <- (not_present_id (label EOG_L) (key ?key5))
  ?npi6 <- (not_present_id (label EOG_R) (key ?key6))
  ?npi7 <- (not_present_id (label EMG_L) (key ?key7))
  ?npi8 <- (not_present_id (label EMG_R) (key ?key8))
  ?npi9 <- (not_present_id (label EKG) (key ?key9))
  ?npi10 <- (not_present_id (label SaO2) (key ?key10))
  ?npi11 <- (not_present_id (label PWave) (key ?key11))
  ?npi12 <- (not_present_id (label Flow) (key ?key12))
  ?npi13 <- (not_present_id (label Mic) (key ?key13))
  ?npi14 <- (not_present_id (label RIP_AB) (key ?key14))
  ?npi15 <- (not_present_id (label RIP_RC) (key ?key15))
  =>
  (CLIPS_Bad_State ?chan1)
  (CLIPS_Bad_State ?chan2)
  (CLIPS_Bad_State ?chan3)
  (CLIPS_Bad_State ?chan4)
  (CLIPS_Bad_State ?chan5)
  (CLIPS_Bad_State ?chan6)
  (CLIPS_Bad_State ?chan7)
  (CLIPS_Bad_State ?chan8)
  (CLIPS_Bad_State ?chan9)
  (CLIPS_Bad_State ?chan10)
  (CLIPS_Bad_State ?chan11)
  (CLIPS_Bad_State ?chan12)
  (CLIPS_Bad_State ?chan13)
  (CLIPS_Bad_State ?chan14)
  (CLIPS_Bad_State ?chan15)
  (modify ?s1 (stable no))
  (modify ?s2 (stable no))
  (modify ?s3 (stable no))
  (modify ?s4 (stable no))
  (modify ?s5 (stable no))
  (modify ?s6 (stable no))
  (modify ?s7 (stable no))
  (modify ?s8 (stable no))
  (modify ?s9 (stable no))
  (modify ?s10 (stable no))
  (modify ?s11 (stable no))
  (modify ?s12 (stable no))
```

```
   (modify ?s13 (stable no))
   (modify ?s14 (stable no))
   (modify ?s15 (stable no))
   (modify ?npi (displayed yes))
   (modify ?npi1 (displayed yes))
   (modify ?npi2 (displayed yes))
   (modify ?npi3 (displayed yes))
   (modify ?npi4 (displayed yes))
   (modify ?npi5 (displayed yes))
   (modify ?npi6 (displayed yes))
   (modify ?npi7 (displayed yes))
   (modify ?npi8 (displayed yes))
   (modify ?npi9 (displayed yes))
   (modify ?npi10 (displayed yes))
   (modify ?npi11 (displayed yes))
   (modify ?npi12 (displayed yes))
   (modify ?npi13 (displayed yes))
   (modify ?npi14 (displayed yes))
   (modify ?npi15 (displayed yes))
   (CLIPS_Clear_Message ?key1)
   (CLIPS_Clear_Message ?key2)
   (CLIPS_Clear_Message ?key3)
   (CLIPS_Clear_Message ?key4)
   (CLIPS_Clear_Message ?key5)
   (CLIPS_Clear_Message ?key6)
   (CLIPS_Clear_Message ?key7)
   (CLIPS_Clear_Message ?key8)
   (CLIPS_Clear_Message ?key9)
   (CLIPS_Clear_Message ?key10)
   (CLIPS_Clear_Message ?key11)
   (CLIPS_Clear_Message ?key12)
   (CLIPS_Clear_Message ?key13)
   (CLIPS_Clear_Message ?key14)
   (CLIPS_Clear_Message ?key15)
   (CLIPS_Warning_Message ?chan1 ?key)
)

;;; ---------------------------------------------------------------------
(defrule All_Not_Present_2 ""
   (full_buffer)
   (not_present_id (label All_Not_Present) (displayed yes))
  ?npi <- (not_present_id (label
EP_Flow_Mic_Not_Present|EP_Not_Present|CR_Not_Present|RIP_Not_Present)
                          (key ?key) (displayed yes))
 =>
   (CLIPS_Clear_Message ?key)
)

;;; ---------------------------------------------------------------------
(defrule Head_Not_Present ""
   (full_buffer)
   (not_present_id (label All_Not_Present) (displayed no))
  ?npi <- (not_present_id (label EP_Flow_Mic_Not_Present) (key ?key)
(displayed no))
  ?s1 <- (signal (label C3) (chan ?chan1) (present no|unknown) (quality
unknown))
```

```
  ?s2 <- (signal (label O1) (chan ?chan2) (present no|unknown) (quality
unknown))
  ?s3 <- (signal (label C4) (chan ?chan3) (present no|unknown) (quality
unknown))
  ?s4 <- (signal (label O2) (chan ?chan4)  (present no|unknown)
(quality unknown))
  ?s5 <- (signal (label EOG_L) (chan ?chan5) (present no|unknown)
(quality unknown))
  ?s6 <- (signal (label EOG_R) (chan ?chan6) (present no|unknown)
(quality unknown))
  ?s7 <- (signal (label EMG_L) (chan ?chan7) (present ?p7) (quality
?q7))
  ?s8 <- (signal (label EMG_R) (chan ?chan8) (present ?p8) (quality
?q8))
  ?s12 <- (signal (label Flow) (chan ?chan12) (present no|unknown)
(quality unknown))
  ?s13 <- (signal (label Mic) (chan ?chan13) (present no|unknown)
(quality unknown))
  ?npi1 <- (not_present_id (label C3) (key ?key1))
  ?npi2 <- (not_present_id (label O1) (key ?key2))
  ?npi3 <- (not_present_id (label C4) (key ?key3))
  ?npi4 <- (not_present_id (label O2) (key ?key4))
  ?npi5 <- (not_present_id (label EOG_L) (key ?key5))
  ?npi6 <- (not_present_id (label EOG_R) (key ?key6))
  ?npi7 <- (not_present_id (label EMG_L) (key ?key7))
  ?npi8 <- (not_present_id (label EMG_R) (key ?key8))
  ?npi12 <- (not_present_id (label Flow) (key ?key12))
  ?npi13 <- (not_present_id (label Mic) (key ?key13))
 =>
  (CLIPS_Bad_State ?chan1)
  (CLIPS_Bad_State ?chan2)
  (CLIPS_Bad_State ?chan3)
  (CLIPS_Bad_State ?chan4)
  (CLIPS_Bad_State ?chan5)
  (CLIPS_Bad_State ?chan6)
  (CLIPS_Bad_State ?chan7)
  (CLIPS_Bad_State ?chan8)
  (CLIPS_Bad_State ?chan12)
  (CLIPS_Bad_State ?chan13)
  (modify ?s1 (stable no))
  (modify ?s2 (stable no))
  (modify ?s3 (stable no))
  (modify ?s4 (stable no))
  (modify ?s5 (stable no))
  (modify ?s6 (stable no))
  (modify ?s7 (stable no))
  (modify ?s8 (stable no))
  (modify ?s12 (stable no))
  (modify ?s13 (stable no))
  (modify ?npi (displayed yes))
  (modify ?npi1 (displayed yes))
  (modify ?npi2 (displayed yes))
  (modify ?npi3 (displayed yes))
  (modify ?npi4 (displayed yes))
  (modify ?npi5 (displayed yes))
  (modify ?npi6 (displayed yes))
  (modify ?npi7 (displayed yes))
```

```
  (modify ?npi8 (displayed yes))
  (modify ?npi12 (displayed yes))
  (modify ?npi13 (displayed yes))
  (CLIPS_Clear_Message ?key1)
  (CLIPS_Clear_Message ?key2)
  (CLIPS_Clear_Message ?key3)
  (CLIPS_Clear_Message ?key4)
  (CLIPS_Clear_Message ?key5)
  (CLIPS_Clear_Message ?key6)
  (CLIPS_Clear_Message ?key7)
  (CLIPS_Clear_Message ?key8)
  (CLIPS_Clear_Message ?key12)
  (CLIPS_Clear_Message ?key13)
  (CLIPS_Warning_Message ?chan1 ?key)
)

;;; ---------------------------------------------------------------------
(defrule Head_Not_Present_2 ""
  (full_buffer)
  (not_present_id (label EP_Flow_Mic_Not_Present) (displayed yes))
  ?npi <- (not_present_id (label
EP_Not_Present|CR_Not_Present|RIP_Not_Present)
                          (key ?key) (displayed yes))
 =>
  (CLIPS_Clear_Message ?key)
)

;;; ---------------------------------------------------------------------
(defrule EP_Not_Present ""
  (full_buffer)
  (not_present_id (label All_Not_Present) (displayed no))
  (not_present_id (label EP_Flow_Mic_Not_Present) (displayed no))
  ?npi <- (not_present_id (label EP_Not_Present) (key ?key) (displayed
no))
  ?s1 <- (signal (label C3) (chan ?chan1) (present no|unknown) (quality
unknown))
  ?s2 <- (signal (label O1) (chan ?chan2) (present no|unknown) (quality
unknown))
  ?s3 <- (signal (label C4) (chan ?chan3) (present no|unknown) (quality
unknown))
  ?s4 <- (signal (label O2) (chan ?chan4)  (present no|unknown)
(quality unknown))
  ?s5 <- (signal (label EOG_L) (chan ?chan5) (present no|unknown)
(quality unknown))
  ?s6 <- (signal (label EOG_R) (chan ?chan6) (present no|unknown)
(quality unknown))
  ?s7 <- (signal (label EMG_L) (chan ?chan7) (present ?p7) (quality
?q7))
  ?s8 <- (signal (label EMG_R) (chan ?chan8) (present ?p8) (quality
?q8))
  ?npi1 <- (not_present_id (label C3) (key ?key1))
  ?npi2 <- (not_present_id (label O1) (key ?key2))
  ?npi3 <- (not_present_id (label C4) (key ?key3))
  ?npi4 <- (not_present_id (label O2) (key ?key4))
  ?npi5 <- (not_present_id (label EOG_L) (key ?key5))
  ?npi6 <- (not_present_id (label EOG_R) (key ?key6))
  ?npi7 <- (not_present_id (label EMG_L) (key ?key7))
```

```
  ?npi8 <- (not_present_id (label EMG_R) (key ?key8))
 =>
  (CLIPS_Bad_State ?chan1)
  (CLIPS_Bad_State ?chan2)
  (CLIPS_Bad_State ?chan3)
  (CLIPS_Bad_State ?chan4)
  (CLIPS_Bad_State ?chan5)
  (CLIPS_Bad_State ?chan6)
  (CLIPS_Bad_State ?chan7)
  (CLIPS_Bad_State ?chan8)
  (modify ?s1 (stable no))
  (modify ?s2 (stable no))
  (modify ?s3 (stable no))
  (modify ?s4 (stable no))
  (modify ?s5 (stable no))
  (modify ?s6 (stable no))
  (modify ?s7 (stable no))
  (modify ?s8 (stable no))
  (modify ?npi (displayed yes))
  (modify ?npi1 (displayed yes))
  (modify ?npi2 (displayed yes))
  (modify ?npi3 (displayed yes))
  (modify ?npi4 (displayed yes))
  (modify ?npi5 (displayed yes))
  (modify ?npi6 (displayed yes))
  (modify ?npi7 (displayed yes))
  (modify ?npi8 (displayed yes))
  (CLIPS_Clear_Message ?key1)
  (CLIPS_Clear_Message ?key2)
  (CLIPS_Clear_Message ?key3)
  (CLIPS_Clear_Message ?key4)
  (CLIPS_Clear_Message ?key5)
  (CLIPS_Clear_Message ?key6)
  (CLIPS_Clear_Message ?key7)
  (CLIPS_Clear_Message ?key8)
  (CLIPS_Warning_Message ?chan1 ?key)
)

;;; ---------------------------------------------------------------------
(defrule CR_Not_Present ""
  (full_buffer)
  ?npi <- (not_present_id (label CR_Not_Present) (key ?key) (displayed
no))
  ?s9 <- (signal (label EKG) (chan ?chan9) (present no|unknown)
(quality unknown))
  ?s10 <- (signal (label SaO2) (chan ?chan10) (present no|unknown)
(quality unknown))
  ?s11 <- (signal (label PWave) (chan ?chan11) (present ?p11) (quality
?q11))
  ?s12 <- (signal (label Flow) (chan ?chan12) (present no|unknown)
(quality unknown))
  ?s13 <- (signal (label Mic) (chan ?chan13) (present no|unknown)
(quality unknown))
  ?s14 <- (signal (label RIP_AB) (chan ?chan14) (present no|unknown)
(quality unknown))
  ?s15 <- (signal (label RIP_RC) (chan ?chan15)  (present no|unknown)
(quality unknown))
```

```
  (not_present_id (label All_Not_Present) (displayed no))
  ?npi9 <- (not_present_id (label EKG) (key ?key9))
  ?npi10 <- (not_present_id (label SaO2) (key ?key10))
  ?npi11 <- (not_present_id (label PWave) (key ?key11))
  ?npi12 <- (not_present_id (label Flow) (key ?key12))
  ?npi13 <- (not_present_id (label Mic) (key ?key13))
  ?npi14 <- (not_present_id (label RIP_AB) (key ?key14))
  ?npi15 <- (not_present_id (label RIP_RC) (key ?key15))
  =>
  (CLIPS_Bad_State ?chan9)
  (CLIPS_Bad_State ?chan10)
  (CLIPS_Bad_State ?chan11)
  (CLIPS_Bad_State ?chan12)
  (CLIPS_Bad_State ?chan13)
  (CLIPS_Bad_State ?chan14)
  (CLIPS_Bad_State ?chan15)
  (modify ?s9 (stable no))
  (modify ?s10 (stable no))
  (modify ?s11 (stable no))
  (modify ?s12 (stable no))
  (modify ?s13 (stable no))
  (modify ?s14 (stable no))
  (modify ?s15 (stable no))
  (modify ?npi (displayed yes))
  (modify ?npi9 (displayed yes))
  (modify ?npi10 (displayed yes))
  (modify ?npi11 (displayed yes))
  (modify ?npi12 (displayed yes))
  (modify ?npi13 (displayed yes))
  (modify ?npi14 (displayed yes))
  (modify ?npi15 (displayed yes))
  (CLIPS_Clear_Message ?key9)
  (CLIPS_Clear_Message ?key10)
  (CLIPS_Clear_Message ?key11)
  (CLIPS_Clear_Message ?key12)
  (CLIPS_Clear_Message ?key13)
  (CLIPS_Clear_Message ?key14)
  (CLIPS_Clear_Message ?key15)
  (CLIPS_Warning_Message ?chan9 ?key)
)

;;; ---------------------------------------------------------------------
(defrule CR_Not_Present_2 ""
  (full_buffer)
  (not_present_id (label CR_Not_Present) (displayed yes))
  ?npi <- (not_present_id (label RIP_Not_Present) (key ?key) (displayed
yes))
 =>
  (CLIPS_Clear_Message ?key)
)

;;; ---------------------------------------------------------------------
(defrule RIP_Not_Present ""
  (full_buffer)
  (not_present_id (label All_Not_Present) (displayed no))
  (not_present_id (label CR_Not_Present) (displayed no))
```

```
  ?npi <- (not_present_id (label RIP_Not_Present) (key ?key) (displayed
no))
  ?s1 <- (signal (label RIP_AB) (chan ?chan14) (present no) (quality
unknown))
  ?s2 <- (signal (label RIP_RC) (chan ?chan15)  (present no) (quality
unknown))
  ?npi14 <- (not_present_id (label RIP_AB) (key ?key14))
  ?npi15 <- (not_present_id (label RIP_RC) (key ?key15))
  =>
  (CLIPS_Bad_State ?chan14)
  (CLIPS_Bad_State ?chan15)
  (modify ?s1 (stable no))
  (modify ?s2 (stable no))
  (modify ?npi (displayed yes))
  (modify ?npi14 (displayed yes))
  (modify ?npi15 (displayed yes))
  (CLIPS_Clear_Message ?key14)
  (CLIPS_Clear_Message ?key15)
  (CLIPS_Warning_Message ?chan14 ?key)
)

;;; ------------------------------------------------------------------
(defrule Channel_Not_Present ""
  (full_buffer)
  ?s  <- (signal (label ?label) (chan ?chan) (present no) (quality
unkown))
  ?npi <- (not_present_id (label ?label) (key ?key) (displayed no))
  =>
  (CLIPS_Bad_State ?chan)
  (modify ?s (stable no))
  (modify ?npi (displayed yes))
  (CLIPS_Warning_Message ?chan ?key)
)

;;;   ***********************************************
;;;   *                                             *
;;;   * Full Buffer Rule.                           *
;;;   *                                             *
;;;   ***********************************************

;;; ------------------------------------------------------------------
(defrule Full_Buffer ""
  ?old <- (full_buffer)
  =>
  (retract ?old)
)

;;;   ***********************************************
;;;   *                                             *
;;;   * Quality Update Rules.                       *
;;;   *                                             *
;;;   ***********************************************

;;; ------------------------------------------------------------------
(defrule Good_Quality ""
  (signal (label ?label) (chan ?chan) (present yes) (quality good))
  (poor_quality_id (label ?label) (displayed no|none))
```

```
  =>
  (CLIPS_Good_State ?chan)
)

;;; ---------------------------------------------------------------------
(defrule Bad_Quality ""
  ?s  <- (signal (label ?label) (chan ?chan) (present yes) (quality
bad))
  ?pqi <- (poor_quality_id (label ?label) (key ?key) (displayed no))
  =>
  (modify ?s (stable no))
  (modify ?pqi (displayed yes))
  (CLIPS_Bad_State ?chan)
  (CLIPS_Warning_Message ?chan ?key)
)

;;; ---------------------------------------------------------------------
(defrule Unknown_Quality ""
  (signal (label ?label) (chan ?chan) (present yes) (quality unknown))
  (poor_quality_id (label ?label) (displayed no|none))
  =>
  (CLIPS_Unknown_State ?chan)
)

;;;*****************************************************
;;;*                                                   *
;;;*                      DEFFACTS                     *
;;;*                                                   *
;;;* Note: These are the initial facts. They are reload-*
;;;*       ed after a RESET is performed.              *
;;;*****************************************************

(deffacts signal_setup
 (signal (label C3) (chan 1) (present unknown) (quality unknown) (time
0))
 (signal (label O1) (chan 2) (present unknown) (quality unknown) (time
0))
 (signal (label C4) (chan 3) (present unknown) (quality unknown) (time
0))
 (signal (label O2) (chan 4)  (present unknown) (quality unknown) (time
0))
 (signal (label EOG_L) (chan 5) (present unknown) (quality unknown)
(time 0))
 (signal (label EOG_R) (chan 6) (present unknown) (quality unknown)
(time 0))
 (signal (label EMG_L) (chan 7) (present unknown) (quality unknown)
(time 0))
 (signal (label EMG_R) (chan 8) (present unknown) (quality unknown)
(time 0))
 (signal (label EKG) (chan 18) (present unknown) (quality unknown)
(time 0))
 (signal (label SaO2) (chan 19) (present unknown) (quality unknown)
(time 0))
 (signal (label PWave) (chan 20) (present unknown) (quality unknown)
(time 0))
 (signal (label Flow) (chan 21) (present unknown) (quality unknown)
(time 0))
```

```
 (signal (label Mic) (chan 22) (present unknown) (quality unknown)
(time 0))
 (signal (label RIP_AB) (chan 23) (present unknown) (quality unknown)
(time 0))
 (signal (label RIP_RC) (chan 24) (present unknown) (quality unknown)
(time 0))
 (signal (label MRK) (chan 65) (present unknown) (quality unknown)
(time 0))
)

(deffacts signal_presence_setup
 (signal_presence (label C3) (variance_threshold 20.0))
 (signal_presence (label O1) (variance_threshold 20.0))
 (signal_presence (label C4) (variance_threshold 20.0))
 (signal_presence (label O2) (variance_threshold 20.0))
 (signal_presence (label EOG_L) (variance_threshold 20.0))
 (signal_presence (label EOG_R) (variance_threshold 20.0))
 (signal_presence (label EMG_L) (variance_threshold 5.0))
 (signal_presence (label EMG_R) (variance_threshold 5.0))
 (signal_presence (label Flow) (variance_threshold 0.5))
 (signal_presence (label RIP_AB) (variance_threshold 1.0))
 (signal_presence (label RIP_RC) (variance_threshold 1.0))
)

(deffacts not_present_id_setup
 (not_present_id (label All_Not_Present) (key 0) (displayed no))
 (not_present_id (label EP_Flow_Mic_Not_Present) (key 2) (displayed
no))
 (not_present_id (label EP_Not_Present) (key 3) (displayed no))
 (not_present_id (label CR_Not_Present) (key 5) (displayed no))
 (not_present_id (label RIP_Not_Present) (key 7) (displayed no))
 (not_present_id (label C3) (key 8) (displayed no))
 (not_present_id (label O1) (key 10) (displayed no))
 (not_present_id (label C4) (key 12) (displayed no))
 (not_present_id (label O2) (key 14) (displayed no))
 (not_present_id (label EOG_L) (key 16) (displayed no))
 (not_present_id (label EOG_R) (key 18) (displayed no))
 (not_present_id (label EMG_L) (key 20) (displayed no))
 (not_present_id (label EMG_R) (key 22) (displayed no))
 (not_present_id (label EKG) (key 24) (displayed no))
 (not_present_id (label SaO2) (key 26) (displayed no))
 (not_present_id (label PWave) (key 28) (displayed no))
 (not_present_id (label Flow) (key 30) (displayed no))
 (not_present_id (label Mic) (key 32) (displayed no))
 (not_present_id (label RIP_AB) (key 34) (displayed no))
 (not_present_id (label RIP_RC) (key 36) (displayed no))
 (not_present_id (label MRK) (key 38) (displayed none))
)

(deffacts poor_quality_id_setup
 (poor_quality_id (label All_Poor_Quality) (key 1) (displayed no))
 (poor_quality_id (label EP_Poor_Quality) (key 4) (displayed no))
 (poor_quality_id (label CR_Poor_Quality) (key 6) (displayed no))
 (poor_quality_id (label C3) (key 9) (displayed no))
 (poor_quality_id (label O1) (key 11) (displayed no))
 (poor_quality_id (label C4) (key 13) (displayed no))
 (poor_quality_id (label O2) (key 15) (displayed no))
```

```
  (poor_quality_id (label EOG_L) (key 17) (displayed no))
  (poor_quality_id (label EOG_R) (key 19) (displayed no))
  (poor_quality_id (label EMG_L) (key 21) (displayed no))
  (poor_quality_id (label EMG_R) (key 23) (displayed no))
  (poor_quality_id (label EKG) (key 25) (displayed no))
  (poor_quality_id (label SaO2) (key 27) (displayed no))
  (poor_quality_id (label PWave) (key 29) (displayed no))
  (poor_quality_id (label Flow) (key 31) (displayed no))
  (poor_quality_id (label Mic) (key 33) (displayed no))
  (poor_quality_id (label RIP_AB) (key 35) (displayed no))
  (poor_quality_id (label RIP_RC) (key 37) (displayed no))
  (poor_quality_id (label MRK) (key 39) (displayed none))
)
```

APPENDIX D

Pilot Study Phase 2 Overview and Conclusions

The following report was submitted to NASA Ames and Brigham and Women's Hospital in February 1998.

Evaluation of PI-in-a-Box conducted at Brigham and Women's Hospital

In order to test the accuracy and the reliability of the [PI] diagnostic rules, an informal three-session study was conducted at Brigham and Women's Hospital. The testing required the usage of the full Neurolab Sleep Experiment instrumentation, consisting of the Sleep Net, RIP suit and Borg harness. The testing was conducted by creating several faults in the instrumentation and then observing [PI]'s reaction. Several scenarios were created.

ELECTROPHYSIOLOGICAL SIGNALS

The malfunction scenarios included not scrubbing a site, leaving hair on the site, removing a hydrodot, or a combination of these. Several observations on [PI]'s ability to monitor electrophysiological signals were made.

1. One scenario included the removal of the GROUND hydrodot, which would cause the recorded data to be useless. The absence of the electrode could be observed by the lack of artifacts when the subject moved, as well as the absence of alpha activity when the subject's eyes were closed. [PI] was *not* able to detect the presence of this malfunction because it was still receiving signals from the DSR within the thresholds dictated by its rules. The light therefore stayed green and no diagnostic messages appeared.
2. [PI] does not perform diagnostics on the EMG signals, but does attempt to check for signal presence. This is due to the nature of the signal, which is particularly difficult to analyze. However, one of the scenarios called for the removal of the two right EMG hydrodots and the displayed signals appeared as relatively high amplitude noise. Due to the lack of diagnostics on this signal, however, [PI] still displayed a green light because the signal was above the "Signal Present" threshold.
3. Several artifacts that were picked up by [PI] were due to muscle movements. [PI] would display a red light, which would return green after the subject relaxed. These artifacts were particularly apparent in the EEG and EKG signals. However,

it should be noted that during a realistic instrumentation session, the subject is instructed to remain still and relaxed during the diagnostic procedures.

4. Another scenario involved removing the A2 reference electrode, failing to scrub the C4 EEG electrode site, and scrubbing but leaving hair in the way of the C3 EEG electrode site. In this situation, [PI] displayed amber warning lights for both the C3 EEG and C4 EEG signals, but did not display any diagnostic messages in the Diagnostics window. In addition, the EOG left signal was flat, and [PI] reflected this state with a red light and an appropriate diagnostic message. The O1 EEG signal was flat due to the absence of its reference electrode and [PI] displayed a red warning light accompanied by a diagnostic message.. Once the A2 electrode was inserted, [PI] displayed a green light.
5. It was also noticed that scrubbing a site (therefore lowering the impedance) greatly increased signal clarity, and therefore [PI]'s accuracy.

CARDIORESPIRATORY SIGNALS

The [PI] rules developed for the cardiorespiratory signals are much simpler than those developed for the electrophysiological readings. By testing the instrumentation with [PI], several observations on the rules and the behavior of [PI] were made.

1. SaO_2: [PI]'s rules are currently set to flag a red light if the value is lower than 95. Even if a signal is good and the value is under 95, a red light is displayed. One of the scenarios presented an apparent problem with the reasoning: the complete removal of the pulse oximeter from the finger caused the value to drop to zero and the signal to decay, however, the light stayed green. [PI] performed as expected on the PWave signal by displaying a red light and diagnostic message when the signal decayed.
2. [PI] performed well with the RIP suit signals. When the subject held his breath, therefore preventing the suit from expanding and contracting, the signals appeared almost flat and [PI] responded with a red light. When the subject resumed breathing normally, the signal immediately went back to normal, causing [PI] to change the light back to green.
3. While instrumenting the test subject for this evaluation, the positive and negative EKG leads were accidentally swapped. The resulting signal was nearly flat. [PI] responded appropriately by displaying a red warning light and the associated diagnostic message. Once the leads were correctly attached and a clean signal was obtained, the light changed to green.

DIAGNOSTICS

A sort of "selective" reasoning was implemented in version 3.0 of [PI]. This allows the operator to select the signals for which [PI] will display the diagnostic messages and activate the warning lights. This was extremely useful when using only a certain part of the instrumentation.

A new feature that was also added is the possibility to toggle between long and short diagnostic messages. When the short diagnostics messages are selected, the only thing [PI] displays when picking up a signal artifact is the message "Signal *XYZ* Not Present or Poor Quality", accompanied by the corresponding red light next to the signal. The user is then supposed to consult a reference manual for the appropriate troubleshooting procedures. With the long diagnostic messages activated, [PI] displays not only the message above, but also the relevant malfunction procedures in the Dialog box.

CONCLUSIONS

The testing revealed that [PI] is an important tool in the calibration and troubleshooting procedure. A few modifications, however, are recommended:

1. A completely untrained user might not be able to recognize the absence of the ground electrode just by looking at the signal. [PI] is currently unable to detect this problem. A set of rules to achieve this task is recommended (even if it seems very complicated) based on the frequency of the signal.
2. A set of rules that would detect excessive noise in the EMG is also recommended. Since the EMG looks noisy in general, it might be advisable to keep the status lights amber (indicating unknown quality), in order to encourage the user to use his or her own judgement and not to rely entirely on [PI].
3. The problem encountered with the SaO2 signal seems to be a minor glitch and should be easy to eliminate.

With the appropriate amount of training, [PI] can help a user perform an experiment correctly. It is important that the user know how to read sleep signals with or without the help of [PI]. The pilot study run at MIT showed that the combination of training and [PI] assistance improved the anomaly detection time, and decreased the number of undetected anomalies. The users should also be trained in the use of [PI]'s diagnostic messages, instead of just having them monitor the status lights. Considering the successful combination of training and [PI] assistance indicated by the pilot study results, it would not be beneficial to entirely shut off [PI]'s reasoning and simply use it as a signal display.

APPENDIX E

Consent Form and Subject Questionnaire

E.1 Consent Form

INFORMED CONSENT FORM (Pilot Study Phase 1)

Purpose

We would like permission to enroll you in a research study. The purpose of this study is to evaluate the efficacy of an expert system called PI-in-a-Box in identifying the presence of artifacts in sleep data. A version of PI-in-a-Box has already been developed to assist astronauts in performing a sleep experiment in space. This experiment is designed to quantify the effectiveness of an expert system in a laboratory environment in terms of both time and accuracy.

Participation in this study is voluntary and you are free to withdraw your consent and discontinue participation in the experiment at any time without prejudice.

Procedures

You will be given one hour of training followed by a short quiz intended to provide an overview of the equipment used in sleep recordings and the characteristics of each signal recorded. In addition, you will be introduced to various artifacts which are common in these sleep data. The potential sources of these artifacts will be described to you.

For the test sessions, you will be presented with a display of pre-recorded sleep signals. You will be asked to identify the presence of artifacts in the data and to determine the cause of each artifact. The testing will take place over the course of two, 30-minute sessions. Total testing time will be approximately 1 hour.

Risks and Discomforts

There are no known risks associated with this experiment.

Benefits

Monetary compensation will be provided to participants at a rate of $7.00 per hour.

In the unlikely event of a physical injury resulting from participation in this research, I understand that medical treatment will be available from the MIT Medical Department, including first aid emergency treatment and follow-up care as needed, and that my insurance carrier may be billed for the cost of such treatment. However, no compensation can be provided for medical apart from the foregoing. I further understand that making such medical treatment available; or providing it,

does not imply that such injury is the Investigator's fault. I also understand that by my participation in this study, I am not waiving any of my legal rights.

I understand that I may also contact the Chairman of the Committee on the Use of Humans as Experimental Subjects, MIT 253-6787, if I feel I have been treated unfairly as a subject.

Signature

I have been fully informed as to the procedures to be followed, including those which are investigational, and have been given a description of the attendant discomforts, risks, and benefits to be expected. In signing this consent form, I agree to participate in the project and I understand that I am free to withdraw my consent and have this study discontinued at any time. I understand also that if I have any questions at any time, they will be answered.

_____ _____

Subject's Signature Date

E.2 Subject Questionnaire

Subject Number: _____
Phase: I II
Date: _____

Principal-Investigator-in-a-Box
Pilot Study

January 1998

Subject

Name:_____

Office Phone Number:_____

Home Phone Number:_____

E-Mail Address:_____

If you are not a Man-Vehicle Lab staff member, fill out the following for compensation purposes:

SSN:_____

Address:_____

_____

==========

Date of Birth:_____

Gender: M F

Year in Graduate School: 1 2 3 4 5 6 7 8 9 More

Field of Study:_____

==========

How many hours per week do you use a personal computer or workstation?

Have you ever been exposed to or worked on a sleep experiment? YES NO

(If YES, please elaborate.) _____

Are you color blind? YES NO

Do you wear corrective lenses? YES NO

If YES, are you currently wearing GLASSES or CONTACTS (circle one)

Are you right handed? YES NO

APPENDIX F

Sample Quiz and Reference Manual

F.1 Sample Quiz

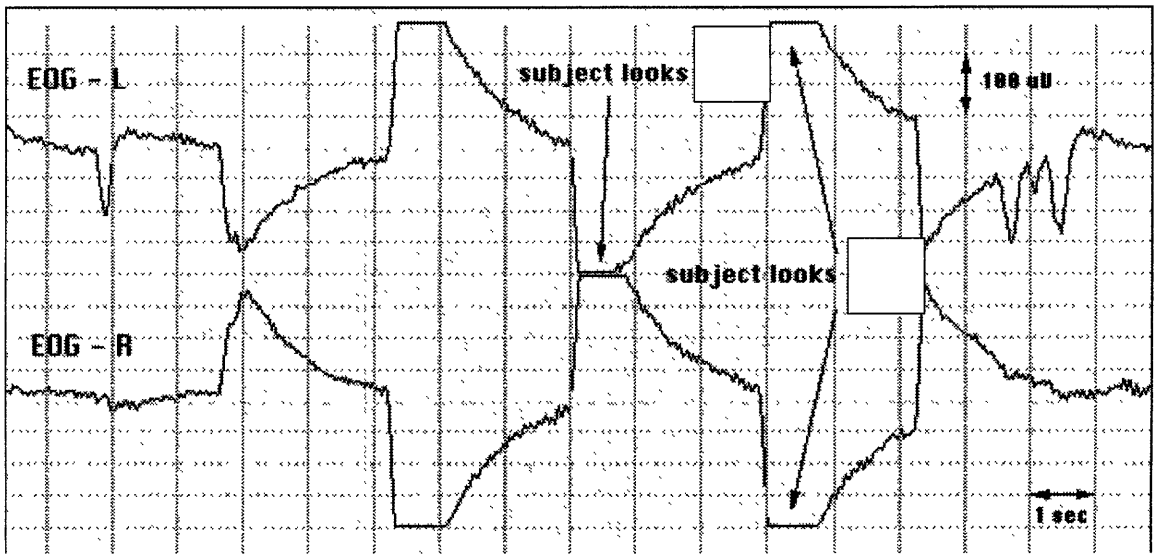
QUIZ

NAME:

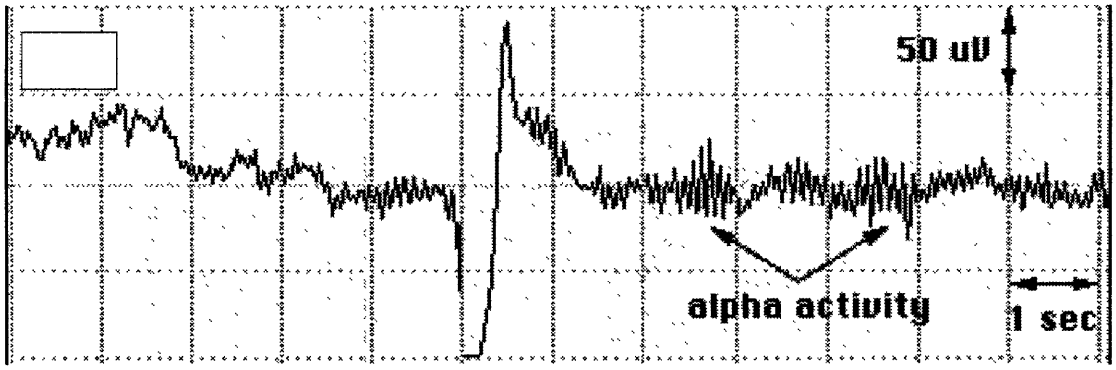
SUBJECT #:

1. Circle the electrophysiological signals displayed on the [PI] window:
   a. EEG
   b. P-Wave
   c. EOG
   d. SaO_2
   e. EMG
   f. EKG
   g. ECG
   h. REM

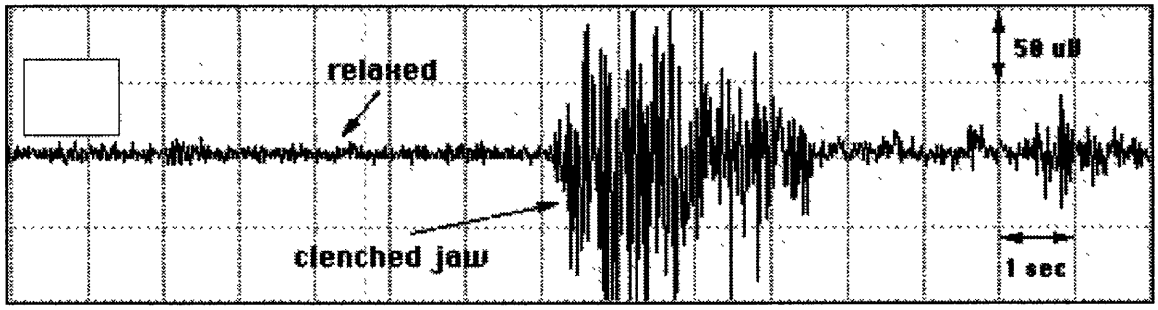
2. Where is the subject looking (fill in the boxes)?



3. What type of signal is this? EEG, EKG, EOG, EMG (circle one or fill in the box)?

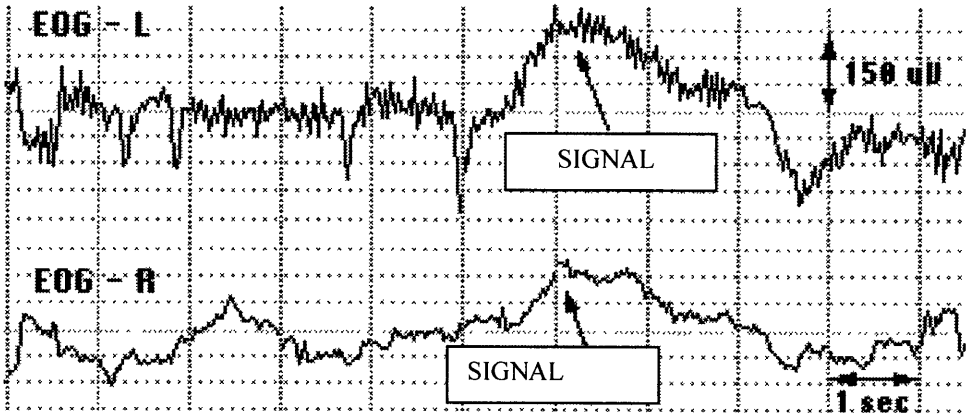


4. What type of signal is this? EEG, EKG, EOG, EMG (circle one or fill in the box)?

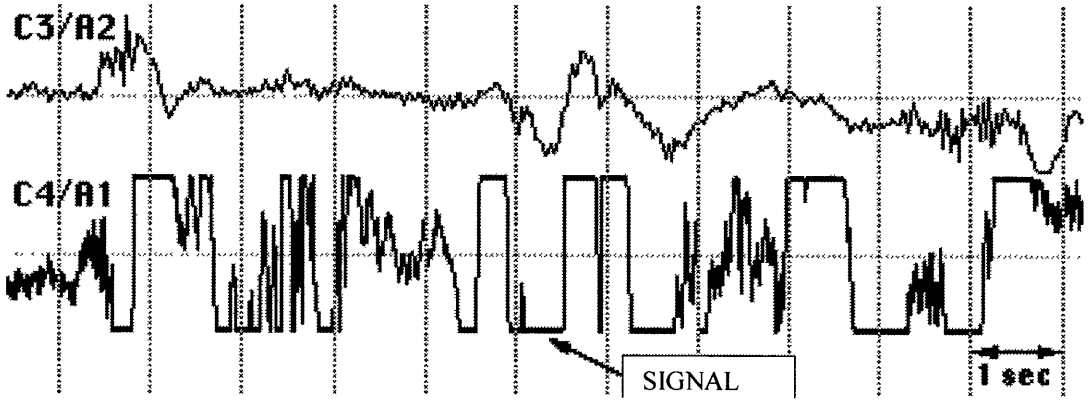


5. Which one is NOT an anomaly type?
   a. Flat signal
   b. Prepping signal
   c. Noisy signal

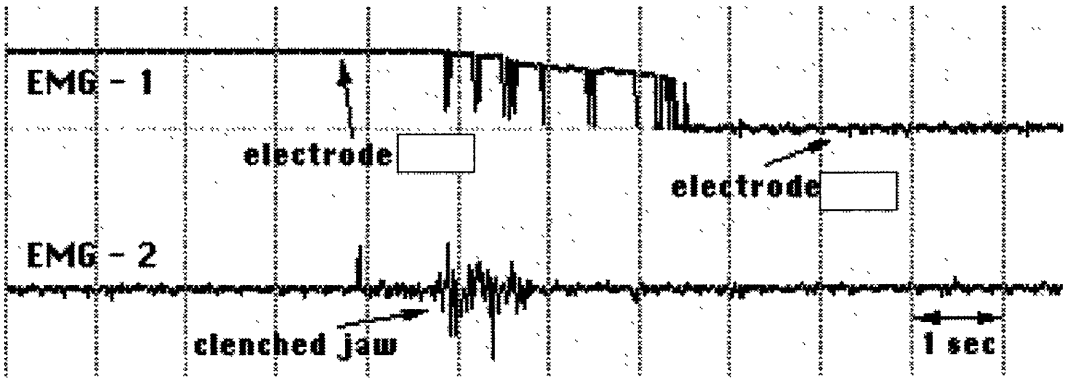
6. Which of these signals is a clean signal and which one is not? What kind of anomaly is present?
    a. Popping
    b. Flat signal
    c. Noise



7. Which of these EEG signals is a clean signal and which one is not?, What kind of anomaly is present?
    a. Flat signal
    b. Popping
    c. Noise



8. Which of these EMG signals is a clean signal and which one is not?, What kind of anomaly is present?
    a. Flat signal
    b. Popping
    c. Noise



9. Feel free to add any comments or recommendations about the quiz, the training session or the experiment.

F.2 Reference Manual

PI-in-a-Box

[PI]

PILOT STUDY REFERENCE MANUAL

PHASE I

Prepared by:

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Susanne M. Essig

Principal Investigator: Prof. Laurence Young

Massachusetts Institute of Technology
Man-Vehicle Laboratory
January 1998

INDEX

This reference manual was assembled using material (i.e. text and pictures) from the [PI] NSBRI proposal (by L.R. Young, R. L. Smith, G. Callini and S. M. Essig) and Robin L. Smith's Master's Thesis.

INTRODUCTION AND BACKGROUND

We have been developing "expert systems" to bring the computer to the assistance of the crew in space as an intelligent decision aid. In particular, we have developed "Principal Investigator in a Box", or [PI], to capture the reasoning process of the real expert - the Principal Investigator - and combine that with real time data available in space in order to advise the astronaut about how to proceed in real time. When functioning ideally, [PI] advises the astronaut during the progress of an experiment much the way a real PI looking over the crew's shoulder would perform.

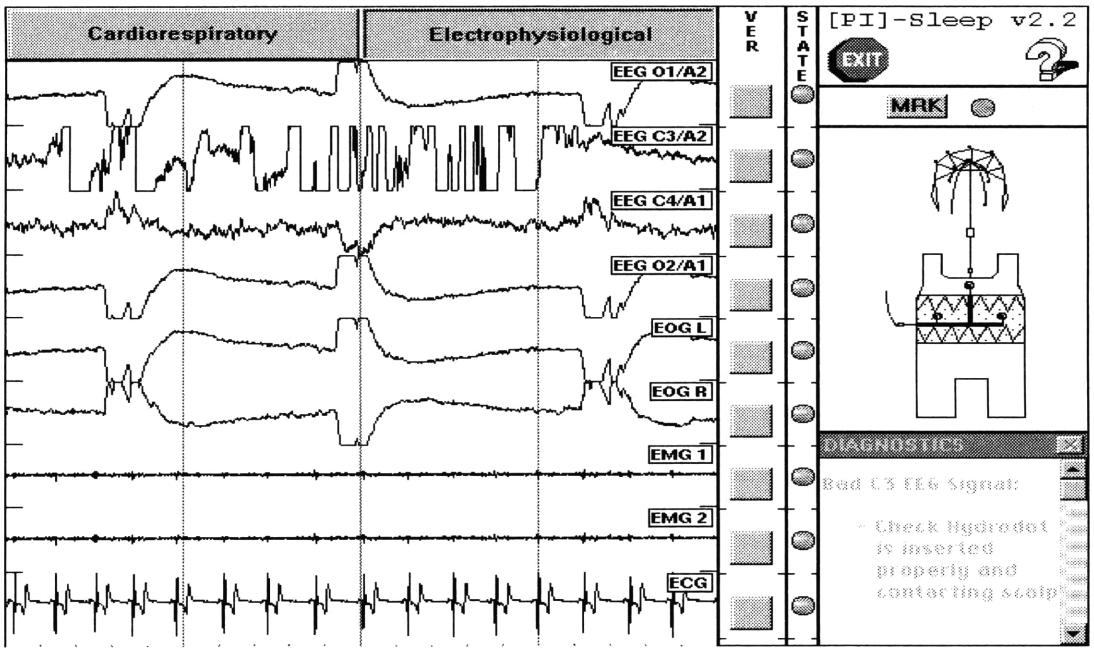
The latest version of [PI] will fly on the Space Shuttle Columbia in April 1998 as part of

the Neurolab project. This version of [PI] will help astronauts troubleshoot the instrumentation for the Sleep Experiment. [PI] will analyze the signals coming from the instrumentation (applied

to an astronaut) and report on the signal quality. If there are any problems or anomalies associated with the signals, [PI] will report the problem and list a series of possible ways to fix them.

INTERFACE

The [PI] interface is shown in the figure below. The raw electrophysiological data will be displayed slightly faster than real time (due to the processor's speed) to enable the subjects to view each individual signal. Each vertical line on the display represents five seconds of data (in real time). **The "state" of each signal will be indicated using color-coded LED's, which will enable the subject to determine at a glance which signals require attention**. In addition, the system will alert the user to any problem with the signal quality using both a text and graphic display. The decision aid will attempt to diagnose the underlying cause of the problem by performing a troubleshooting analysis. The subject will then be provided with suggestions and diagnostic procedures for eliminating the problem and returning the signals and system back to its nominal operating state.



[PI] Graphic User Interface

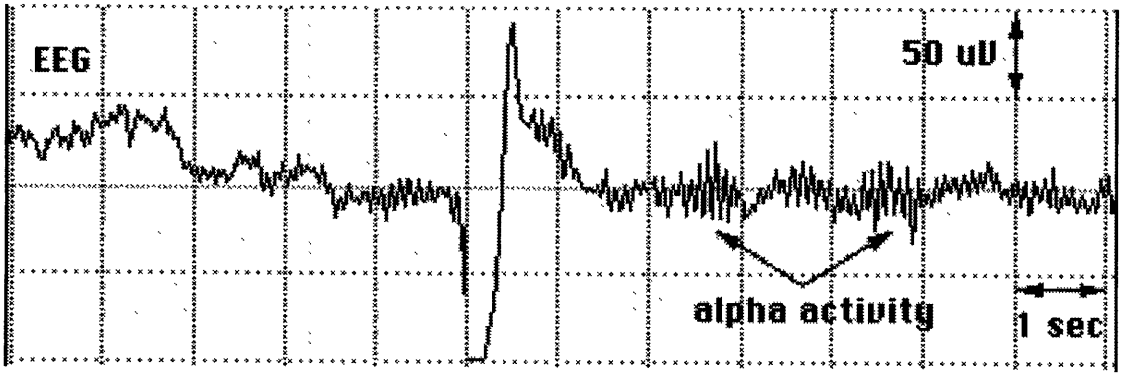
ELECTROPHYSILOGICAL SIGNALS (NORMAL)

Electroencephalogram (EEG)

The electroencephalogram (EEG) is the primary polysomnographic measure used in evaluating and scoring sleep data. The four different stages of non-rapid-eye-movement (NREM) sleep can be distinguished on the EEG signal characteristics.

A pattern known as alpha activity becomes apparent when the subject's eyes are closed.

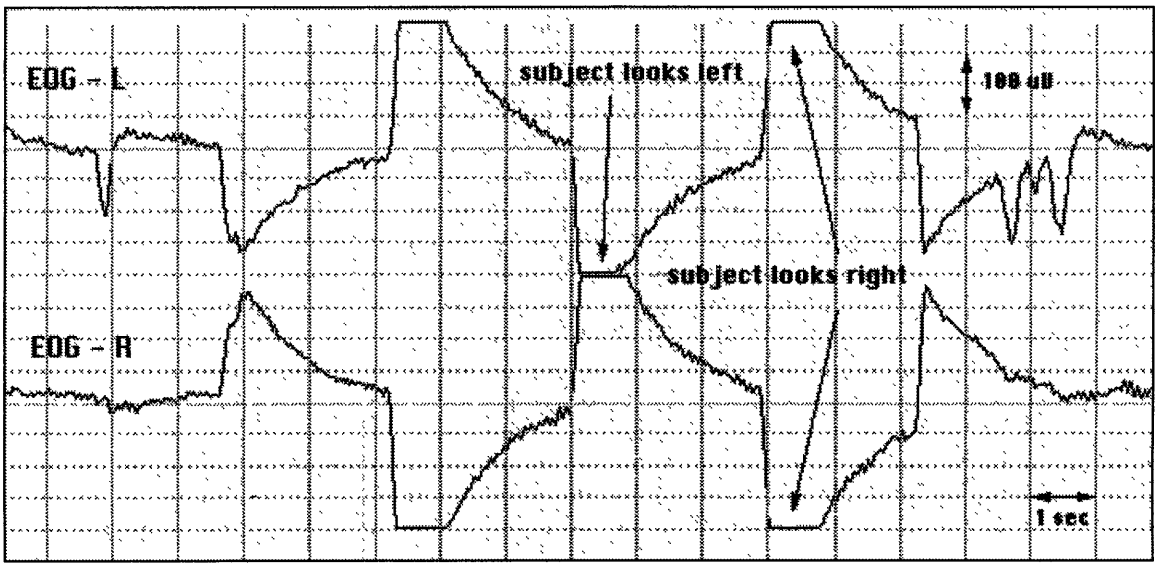
An example of EEG activity is shown below.



Electro-oculogram (EOG) - Left and Right Eye movements

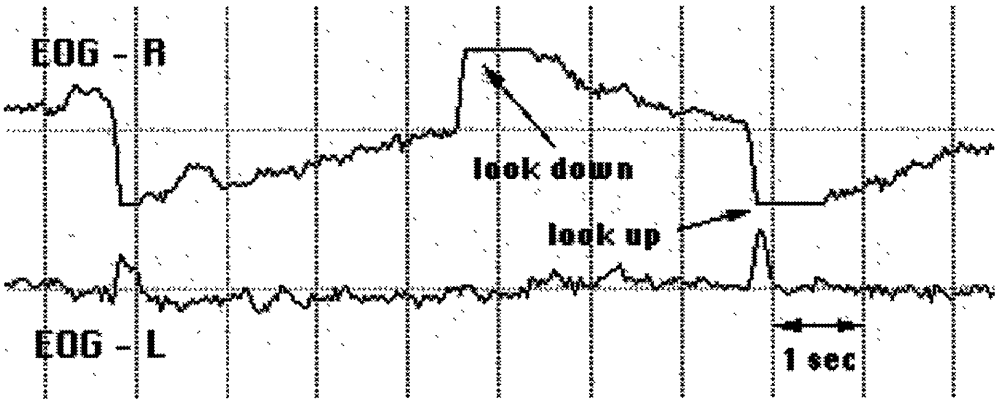
The electro-oculogram (EOG) is recorded in sleep studies primarily to distinguish rapid eye movement sleep from NREM sleep. Each electrode is referenced to the mastoid reference electrode located behind the opposite ear. As a result, the movement of both eyes in either horizontal direction produces a negative voltage in one eye and a positive voltage in the other.

Left eye movements result in a downward (positive) deflection of the left EOG signal and an upward (negative) deflection of the right EOG signal. The reverse happens for eye right movement. An example is shown below.



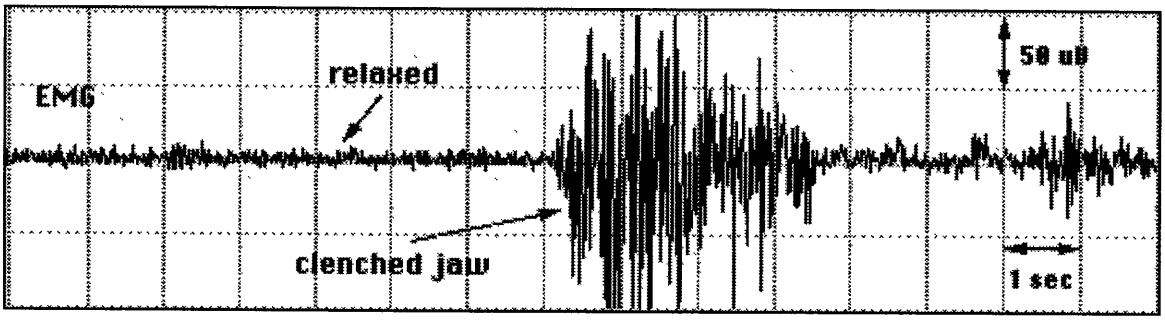
Electro-oculogram (EOG) - Up and Down Eye Movements

Up and down eye movements also produce deflections, but in smaller magnitude. An upward movement of the eyes corresponds to an upward (negative) deflection of the left EOG signal and a downward (positive) deflection of the right EOG signal. The opposite happens for downward eye movements. An example of eye movements is illustrated below.



Electromyogram (EMG)

The electromyogram records muscle activity in the chin, providing information on loss of muscle tone which characterizes REM sleep. The EMG is a higher frequency signal than the EEG and EOG. Movements of the chin and jaw muscles increase the amplitude and frequency of the signal. An example of a good EMG signal is shown below.

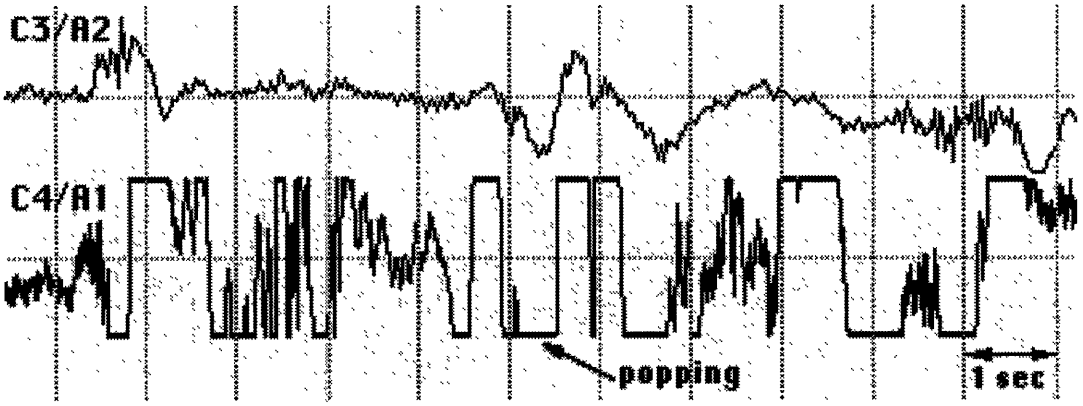


ARTIFACTS

The electrophysiological signals displayed on the [PI] window can present several anomalies due to various problems in the instrumentation (i.e. incorrect setup).

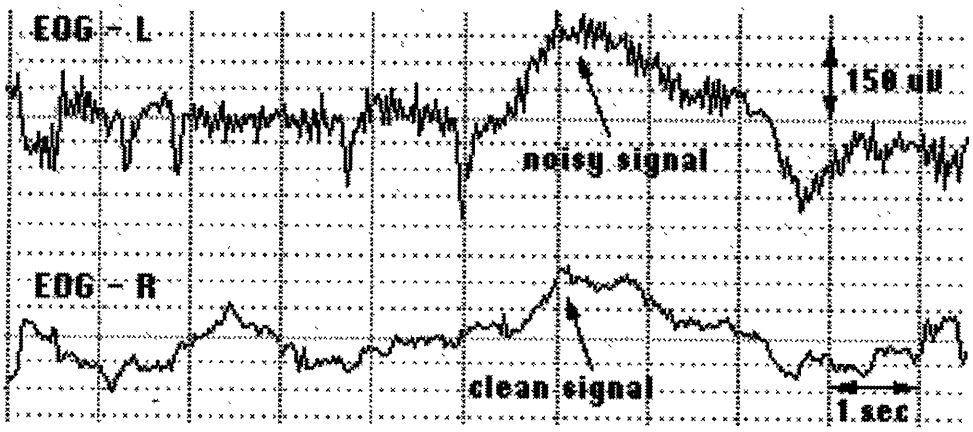
The absence of a signal can be caused by a poorly placed electrode, insufficient scrubbing of the electrode site, hair beneath the hydrodot or hardware malfunction. These artifacts can be grouped in three major categories, even though the actual range of anomalies possible is quite vast. Examples of the visual aspect of these artifacts are given below for some particular signals. Note that these artifacts can appear on any of the electrophysiological signals displayed by [PI].

POPPING



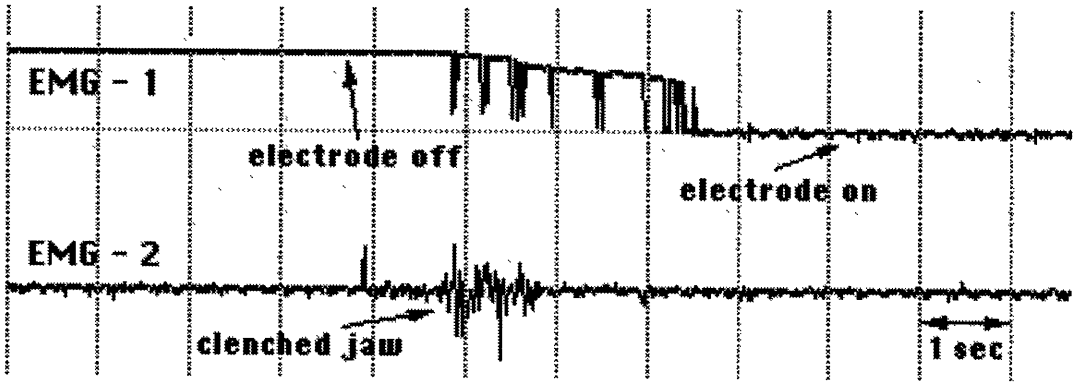
Popping is a condition caused by a poor connection between the scalp and the electrode. The presence of popping in a signal causes the data to be useless. The signal appears intermittently.

NOISE



Excessive amounts of noise can be introduced in a signal as the result of a poor connection between the hydrodot and the skin. On the ground, this condition is even more likely since a loose electrode may allow 60Hz noise to be picked up by a loose electrode.

FLAT SIGNAL



Improper electrode placement can result in poor skin contact as well, resulting in a flat signal.

APPENDIX G

Data File List of Events and Subject Raw Data Response Files

G.1 [PI] List of events for the file "rick61997.vpd."

0:00:19	[PI]	O1_A2 poor quality	*Popping/Flat*
0:00:19	[PI]	C4_A1 poor quality	*Popping*
0:00:19	[PI]	O2_A1 poor quality	*Popping*
0:00:34	[PI]	O2_A1 poor quality	*Popping*
0:00:35	[PI]	EKG poor quality	*Noise*
0:01:12	[PI]	O1_A2 poor quality	*Popping*
0:01:13	[PI]	EKG poor quality	*Noise*
0:01:17	[PI]	O2_A1 poor quality	*Popping*
0:01:36	[PI]	O2_A1 poor quality	*Flat*
0:01:37	[PI]	O1_A2 poor quality	*Popping*
0:01:54	[PI]	O1_A2 poor quality	*Popping*
0:01:58	[PI]	O2_A1 poor quality	*Popping*
0:02:08	[PI]	O1_A2 poor quality	*Popping*
0:02:34	[PI]	EKG poor quality	*Noise*
0:02:34	[PI]	O2_A1 poor quality	*Popping*
0:03:00	[PI]	O2_A1 poor quality	*Popping*
0:03:25	[PI]	EKG poor quality	*Noise*
0:03:30	[PI]	O2_A1 poor quality	*Popping*
0:03:32	[PI]	C4_A1 poor quality	*Popping*
0:03:40	[PI]	C3_A2 poor quality	*Popping*
0:03:50	[PI]	O2_A1 poor quality	*Popping*
0:04:06	[PI]	O2_A1 poor quality	*Popping*
0:04:33	[PI]	O1_A2 poor quality	*Popping*
0:04:34	[PI]	O2_A1 poor quality	*Popping*
0:04:54	[PI]	O2_A1 poor quality	*Saturation (popping)*
0:05:05	[PI]	EKG poor quality	*Noise*
0:05:14	[PI]	O2_A1 poor quality	*Popping*
0:05:24	[PI]	C4_A1 poor quality	*Popping*
0:05:25	[PI]	C3_A2 poor quality	*Popping*
0:06:43	[PI]	O1_A2 poor quality	*Saturation (popping)*
0:06:58	[PI]	C3_A2 poor quality	*Popping*
0:07:14	[PI]	O1_A2 poor quality	*Popping*
0:07:29	[PI]	O1_A2 poor quality	*Saturation (popping)*
0:07:30	[PI]	O2_A1 poor quality	*Popping*
0:07:58	[PI]	O1_A2 poor quality	*Popping/Flat*
0:08:13	[PI]	O1_A2 poor quality	*Popping*
0:08:39	[PI]	O2_A1 poor quality	*Flat*
0:08:58	[PI]	O2_A1 poor quality	*Flat*
0:09:52	[PI]	O1_A2 poor quality	*Popping*
0:09:52	[PI]	O2_A1 poor quality	*Flat*
0:10:16	[PI]	O2_A1 poor quality	*Popping*
0:10:18	[PI]	O1_A2 poor quality	*Saturation (popping)*
0:10:39	[PI]	O1_A2 poor quality	*Popping*
0:10:40	[PI]	O2_A1 poor quality	*Flat*
0:11:32	[PI]	O1_A2 poor quality	*Popping/Flat*

0:12:04	[PI]	O1_A2 poor quality	*Popping/Flat*
0:12:04	[PI]	O2_A1 poor quality	*Saturation (popping)*
0:12:42	[PI]	O2_A1 poor quality	*Flat*
0:13:15	[PI]	O1_A2 poor quality	*Popping*
0:13:15	[PI]	O2_A1 poor quality	*Flat*
0:13:19	[PI]	C4_A1 poor quality	*Popping*
0:13:36	[PI]	O2_A1 poor quality	*Flat*
0:13:42	[PI]	O1_A2 poor quality	*Popping*
0:13:54	[PI]	O1_A2 poor quality	*Popping*
0:14:25	[PI]	O2_A1 poor quality	*Flat*
0:15:18	[PI]	O1_A2 poor quality	*Popping*
0:15:20	[PI]	O2_A1 poor quality	*Popping*
0:15:22	[PI]	C3_A2 poor quality	*Popping*
0:15:23	[PI]	C4_A1 poor quality	*Popping*

G.2 Subject Raw Data Response Files

The response files were labeled using the following code:

SUB*NNPDH*.TXT
Where:

NN	Subject number (1 to 12)
P	Phase Number (1 for this study)
D	Experimental Day (1 or 2)
H	[PI] Assistance (0 for no assistance, 1 for full assistance)

The files were also "cleaned" to eliminate the poor quality warnings that [PI] provided for the cardiorespiratory signals.

sub01110.txt

```
13:11:15  0:00:14  4:O1_A2   Popping
13:11:21  0:00:16  2:C3_A2
13:11:24  0:00:19  [PI]  O1_A2 poor quality
13:11:24  0:00:19  [PI]  C4_A1 poor quality
13:11:24  0:00:19  [PI]  O2_A1 poor quality
13:11:37  0:00:27  4:O1_A2   Popping
13:11:44  0:00:34  [PI]  O2_A1 poor quality
13:11:45  0:00:35  [PI]  EKG poor quality
13:11:52  0:00:36  5:O2_A1   Popping
13:11:56  0:00:37  6:EOG_L   Noise
13:12:31  0:01:12  [PI]  O1_A2 poor quality
13:12:32  0:01:13  [PI]  EKG poor quality
13:12:36  0:01:17  [PI]  O2_A1 poor quality
13:12:40  0:01:19  5:O2_A1   Popping
13:13:06  0:01:29  4:O1_A2   Popping
13:13:13  0:01:36  [PI]  O2_A1 poor quality
13:13:15  0:01:37  [PI]  O1_A2 poor quality
13:13:31  0:01:54  [PI]  O1_A2 poor quality
13:13:38  0:01:58  5:O2_A1   Popping
13:13:38  0:01:58  [PI]  O2_A1 poor quality
13:13:44  0:01:59  4:O1_A2   Popping
13:13:54  0:02:08  [PI]  O1_A2 poor quality
13:14:04  0:02:16  4:O1_A2   Popping
13:14:19  0:02:29  4:O1_A2   Flat
13:14:24  0:02:34  [PI]  EKG poor quality
13:14:24  0:02:34  [PI]  O2_A1 poor quality
13:14:45  0:02:35  5:O2_A1   Popping
13:14:48  0:02:37  4:O1_A2   Popping
13:15:00  0:02:40  3:C4_A1   Popping
13:15:13  0:02:49  4:O1_A2   Popping
13:15:16  0:02:51  5:O2_A1   Popping
13:15:27  0:02:59  4:O1_A2   Popping
13:15:29  0:03:00  [PI]  O2_A1 poor quality
13:15:34  0:03:04  5:O2_A1   Popping
13:15:50  0:03:14  4:O1_A2   Popping
13:15:56  0:03:15  5:O2_A1   Popping
13:16:05  0:03:25  [PI]  EKG poor quality
13:16:09  0:03:26  5:O2_A1   Popping
13:16:17  0:03:29  4:O1_A2   Flat
13:16:18  0:03:30  [PI]  O2_A1 poor quality
```

13:16:20 0:03:32 [PI] C4_A1 poor quality
13:16:23 0:03:34 5:O2_A1   Popping
13:16:28 0:03:35 3:C4_A1   Popping
13:16:33 0:03:40 [PI] C3_A2 poor quality
13:16:51 0:03:49 4:O1_A2   Flat
13:16:52 0:03:50 [PI] O2_A1 poor quality
13:17:00 0:03:56 2:C3_A2   Poppıng
13:17:04 0:03:57 3:C4_A1   Popping
13:17:13 0:04:04 4:O1_A2   Flat
13:17:15 0:04:06 [PI] O2_A1 poor quality
13:17:19 0:04:08 5:O2_A1   Poppıng
13:17:22 0:04:09 3:C4_A1   Popping
13:17:35 0:04:20 4:O1_A2   Poppıng
13:17:48 0:04:33 [PI] O1_A2 poor quality
13:17:49 0:04:34 [PI] O2_A1 poor quality
13:17:59 0:04:36 5:O2_A1   Popping
13:18:05 0:04:39 4:O1_A2   Flat
13:18:20 0:04:54 [PI] O2_A1 poor quality
13:18:28 0:04:57 4:O1_A2   Flat
13:18:33 0:04:59 5:O2_A1   Flat
13:18:40 0:05:05 [PI] EKG poor quality
13:19:01 0:05:11 5:O2_A1   Flat
13:19:05 0:05:14 [PI] O2_A1 poor quality
13:19:10 0:05:16 5:O2_A1   Popping
13:19:13 0:05:17 3:C4_A1   Popping
13:19:18 0:05:20 4:O1_A2   Poppıng
13:19:22 0:05:24 [PI] C4_A1 poor quality
13:19:23 0:05:25 [PI] C3_A2 poor quality
13:19:29 0:05:28 4:O1_A2   Popping
13:19:33 0:05:29 2:C3_A2   Popping
13:19:35 0:05:30 3:C4_A1   Popping
13:19:39 0:05:31 5:O2_A1   Poppıng
13:19:48 0:05:38 5:O2_A1   Popping
13:19:51 0:05:39 3:C4_A1   Poppıng
13:20:06 0:05:49 4:O1_A2   Flat
13:20:17 0:05:59 4:O1_A2   Popping
13:20:41 0:06:19 4:O1_A2   Flat
13:20:58 0:06:29 10:EMGlsm
13:21:12 0:06:43 [PI] O1_A2 poor quality
13:21:17 0:06:46 4:O1_A2
13:21:24 0:06:48 4:O1_A2   Flat
13:21:34 0:06:58 [PI] C3_A2 poor quality
13:21:50 0:07:02 4:O1_A2
13:21:50 0:07:02 [PI] EOG_L poor quality
13:21:58 0:07:07 2:C3_A2   Poppıng
13:22:05 0:07:14 [PI] O1_A2 poor quality
13:22:16 0:07:15 2:C3_A2   Popping
13:22:20 0:07:18 4:O1_A2   Popping
13:22:32 0:07:29 [PI] O1_A2 poor quality
13:22:33 0:07:30 [PI] O2_A1 poor quality
13:22:39 0:07:35 5:O2_A1   Popping
13:22:42 0:07:36 3:C4_A1   Popping
13:22:45 0:07:38 2:C3_A2   Poppıng
13:22:50 0:07:40 4:O1_A2   Popping
13:23:02 0:07:49 5:O2_A1   Flat
13:23:08 0:07:51 4:O1_A2   Poppıng
13:23:15 0:07:58 [PI] O1_A2 poor quality
13:23:24 0:08:01 4:O1_A2   Popping
13:23:26 0:08:03 [PI] EOG_L poor quality
13:23:31 0:08:08 [PI] EOG_R poor quality
13:23:36 0:08:13 [PI] O1_A2 poor quality
13:23:42 0:08:17 4:O1_A2   Flat
13:23:43 0:08:18 [PI] EOG_R poor qualıty
13:23:47 0:08:20 4:O1_A2   Popping
13:23:54 0:08:27 [PI] EOG_L poor qualıty
13:23:55 0:08:28 [PI] EOG_R poor quality
13:24:06 0:08:39 [PI] O2_A1 poor quality
13:24:12 0:08:43 5:O2_A1   Flat
13:24:27 0:08:58 [PI] O2_A1 poor quality
13:24:32 0:09:01 5:O2_A1   Flat
13:24:39 0:09:04 7:EOG_R   Popping

```
13:24:43  0:09:07  [ PI]  EOG_R poor quality
13:24:48  0:09:12  [ PI]  EOG_L poor quality
13:24:55  0:09:17  5:O2_A1   Flat
13:25:29  0:09:52  [ PI]  O1_A2 poor quality
13:25:29  0:09:52  [ PI]  O2_A1 poor quality
13:25:34  0:09:54  4:O1_A2   Popping
13:25:41  0:10:00  5:O2_A1   Flat
13:25:57  0:10:16  [ PI]  O2_A1 poor quality
13:25:59  0:10:17  4:O1_A2   Popping
13:26:00  0:10:18  [ PI]  O1_A2 poor quality
13:26:02  0:10:19  2:C3_A2   Popping
13:26:06  0:10:21  3:C4_A1   Popping
13:26:09  0:10:23  5:O2_A1   Popping
13:26:16  0:10:28  5:O2_A1   Flat
13:26:27  0:10:39  [ PI]  O1_A2 poor quality
13:26:28  0:10:40  [ PI]  O2_A1 poor quality
13:26:37  0:10:44  5:O2_A1   Noise
13:26:37  0:10:44  [ PI]  EOG_L poor quality
13:26:37  0:10:44  [ PI]  EOG_R poor quality
13:26:42  0:10:46  3:C4_A1   Noise
13:26:46  0:10:47  4:O1_A2   Popping
13:26:54  0:10:50  5:O2_A1   Popping
13:27:02  0:10:56  5:O2_A1   Popping
13:27:09  0:11:00  4:O1_A2   Flat
13:27:41  0:11:32  [ PI]  O1_A2 poor quality
13:27:49  0:11:34  4:O1_A2   Popping
13:27:57  0:11:39  4:O1_A2   Popping
13:28:22  0:12:04  [ PI]  O1_A2 poor quality
13:28:22  0:12:04  [ PI]  O2_A1 poor quality
13:28:27  0:12:07  4:O1_A2   Popping
13:28:29  0:12:09  [ PI]  EOG_L poor quality
13:28:33  0:12:10  5:O2_A1   Flat
13:28:37  0:12:13  [ PI]  EOG_R poor quality
13:29:06  0:12:42  [ PI]  O2_A1 poor quality
13:29:12  0:12:46  5:O2_A1   Flat
13:29:41  0:13:15  [ PI]  O1_A2 poor quality
13:29:41  0:13:15  [ PI]  O2_A1 poor quality
13:29:45  0:13:18  5:O2_A1   Flat
13:29:49  0:13:19  4:O1_A2   Popping
13:29:50  0:13:19  [ PI]  C4_A1 poor quality
13:29:53  0:13:20  3:C4_A1   Popping
13:29:54  0:13:20  [ PI]  EOG_R poor quality
13:30:10  0:13:36  [ PI]  O2_A1 poor quality
13:30:20  0:13:41  5:O2_A1   Flat
13:30:21  0:13:42  [ PI]  O1_A2 poor quality
13:30:26  0:13:45  4:O1_A2   Popping
13:30:30  0:13:50  [ PI]  EOG_R poor quality
13:30:34  0:13:54  [ PI]  O1_A2 poor quality
13:30:43  0:13:59  4:O1_A2   Popping
13:30:46  0:14:00  5:O2_A1   Popping
13:30:55  0:14:07  4:O1_A2   Popping
13:31:00  0:14:10  5:O2_A1   Popping
13:31:15  0:14:25  [ PI]  O2_A1 poor quality
13:31:18  0:14:27  4:O1_A2   Flat
13:31:24  0:14:29  5:O2_A1   Flat
13:31:27  0:14:31  2:C3_A2   Popping
13:31:46  0:14:38  5:O2_A1   Flat Other: or saturation
13:31:54  0:14:43  4:O1_A2   Popping
13:31:57  0:14:45  2:C3_A2   Popping
13:32:01  0:14:49  5:O2_A1   Popping
13:32:31  0:15:18  [ PI]  O1_A2 poor quality
13:32:33  0:15:20  [ PI]  O2_A1 poor quality
13:32:36  0:15:21  5:O2_A1   Popping
13:32:37  0:15:22  [ PI]  C3_A2 poor quality
13:32:38  0:15:23  [ PI]  C4_A1 poor quality
13:32:41  0:15:24  3:C4_A1   Popping
13:32:44  0:15:26  2:C3_A2   Popping
13:32:47  0:15:26  4:O1_A2   Popping
```

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13:00:21 0:00:19 [PI] O1_A2 poor quality
13:00:21 0:00:19 [PI] C4_A1 poor quality
13:00:21 0:00:19 [PI] O2_A1 poor quality
13:00:34 0:00:23 4:O1_A2 Popping
13:00:46 0:00:24 3:C4_A1 Flat Other: or saturation
13:00:57 0:00:26 5:O2_A1 Flat Other: or saturation
13:01:05 0:00:34 [PI] O2_A1 poor quality
13:01:19 0:00:35 4:O1_A2 Popping
13:01:19 0:00:35 [PI] EKG poor quality
13:01:23 0:00:37 5:O2_A1 Popping
13:01:33 0:00:41 EKG Noise
13:01:41 0:00:47 4:O1_A2 Flat
13:02:03 0:00:57 4:O1_A2 Other: saturation
13:02:18 0:01:12 [PI] O1_A2 poor quality
13:02:19 0:01:13 [PI] EKG poor quality
13:02:23 0:01:15 4:O1_A2 Popping
13:02:32 0:01:17 EKG Noise
13:02:32 0:01:17 [PI] O2_A1 poor quality
13:02:39 0:01:19 5:O2_A1 Popping
13:02:51 0:01:21 4:O1_A2 Other: saturation
13:03:06 0:01:36 [PI] O2_A1 poor quality
13:03:07 0:01:37 [PI] O1_A2 poor quality
13:03:22 0:01:40 5:O2_A1 Other: saturation
13:03:27 0:01:43 4:O1_A2 Popping
13:03:38 0:01:54 [PI] O1_A2 poor quality
13:03:42 0:01:56 4:O1_A2 Popping
13:03:45 0:01:58 [PI] O2_A1 poor quality
13:03:47 0:01:59 5:O2_A1 Popping
13:04:03 0:02:08 4:O1_A2 Other: saturation
13:04:03 0:02:08 [PI] O1_A2 poor quality
13:04:11 0:02:14 4:O1_A2 Popping
13:04:15 0:02:15 5:O2_A1 Popping
13:04:30 0:02:29 4:O1_A2 Popping
13:04:38 0:02:34 5:O2_A1 Popping
13:04:38 0:02:34 [PI] EKG poor quality
13:04:38 0:02:34 [PI] O2_A1 poor quality
13:04:47 0:02:37 EKG Noise
13:04:52 0:02:39 3:C4_A1 Popping
13:04:56 0:02:41 2:C3_A2 Popping
13:04:59 0:02:43 4:O1_A2 Popping
13:05:03 0:02:44 5:O2_A1 Popping
13:05:09 0:02:48 EKG Noise
13:05:22 0:02:57 5:O2_A1 Popping
13:05:25 0:02:58 4:O1_A2 Popping
13:05:27 0:03:00 [PI] O2_A1 poor quality
13:05:44 0:03:15 4:O1_A2 Popping
13:05:56 0:03:24 5:O2_A1 Popping
13:05:58 0:03:25 [PI] EKG poor quality
13:06:00 0:03:26 EKG Noise
13:06:11 0:03:27 4:O1_A2 Popping
13:06:14 0:03:30 [PI] O2_A1 poor quality
13:06:16 0:03:32 [PI] C4_A1 poor quality
13:06:20 0:03:33 5:O2_A1 Popping
13:06:24 0:03:34 3:C4_A1 Popping
13:06:31 0:03:37 4:O1_A2 Popping
13:06:35 0:03:38 EKG Noise
13:06:36 0:03:40 [PI] C3_A2 poor quality
13:06:42 0:03:44 4:O1_A2 Popping
13:06:45 0:03:45 2:C3_A2 Popping
13:06:51 0:03:50 [PI] O2_A1 poor quality
13:06:55 0:03:53 5:O2_A1 Popping
13:06:59 0:03:55 2:C3_A2 Popping
13:07:02 0:03:56 3:C4_A1 Popping
13:07:06 0:03:58 4:O1_A2 Popping
13:07:16 0:04:05 5:O2_A1
13:07:17 0:04:06 [PI] O2_A1 poor quality
13:07:22 0:04:07 4:O1_A2 Popping
13:07:28 0:04:09 3:C4_A1 Popping
13:07:33 0:04:10 5:O2_A1 Popping
13:07:46 0:04:19 4:O1_A2 Popping
13:08:01 0:04:33 [PI] O1_A2 poor quality

13:08:02 0:04:34 [PI] O2_A1 poor quality
13:08:06 0:04:35 4:O1_A2   Popping
13:08:12 0:04:39 5:O2_A1   Popping
13:08:30 0:04:48 4:O1_A2   Other: saturation
13:08:33 0:04:49 5:O2_A1   Popping
13:08:38 0:04:51 EKG   Noise
13:08:42 0:04:54 [PI] O2_A1 poor quality
13:08:50 0:04:58 5:O2_A1   Other: saturation
13:08:54 0:05:00 4:O1_A2   Popping
13:08:59 0:05:05 [PI] EKG poor quality
13:09:07 0:05:10 EKG   Noise
13:09:13 0:05:13 4:O1_A2   Popping
13:09:14 0:05:14 [PI] O2_A1 poor quality
13:09:19 0:05:16 5:O2_A1   Popping
13:09:23 0:05:18 3:C4_A1   Popping
13:09:26 0:05:20 5:O2_A1   Popping
13:09:29 0:05:21 4:O1_A2   Popping
13:09:33 0:05:24 [PI] C4_A1 poor quality
13:09:34 0:05:25 [PI] C3_A2 poor quality
13:09:36 0:05:26 5:O2_A1   Popping
13:09:39 0:05:27 3:C4_A1   Popping
13:09:43 0:05:28 2:C3_A2   Popping
13:09:48 0:05:29 4:O1_A2   Popping
13:09:59 0:05:39 4:O1_A2   Popping
13:10:03 0:05:40 3:C4_A1
13:10:20 0:05:52 4:O1_A2   Popping
13:10:49 0:06:15 4:O1_A2   Other: saturation
13:11:10 0:06:30 4:O1_A2   Other: saturation
13:11:24 0:06:41 EKG   Noise
13:11:26 0:06:43 [PI] O1_A2 poor quality
13:11:32 0:06:44 5:O2_A1   Popping
13:11:40 0:06:47 4:O1_A2   Other: saturation
13:11:51 0:06:58 [PI] C3_A2 poor quality
13:11:55 0:07:00 2:C3_A2   Popping
13:11:57 0:07:02 [PI] EOG_L poor quality
13:12:05 0:07:03 3:C4_A1   Popping
13:12:36 0:07:04 6:EOG_L   Popping Other: or saturation
13:12:52 0:07:06 7:EOG_R   Popping Other: or saturation
13:12:55 0:07:08 2:C3_A2   Popping
13:13:02 0:07:14 [PI] O1_A2 poor quality
13:13:08 0:07:15 2:C3_A2   Other: saturation
13:13:14 0:07:16 4:O1_A2   Popping
13:13:26 0:07:29 [PI] O1_A2 poor quality
13:13:29 0:07:30 4:O1_A2   Popping
13:13:29 0:07:30 [PI] O2_A1 poor quality
13:13:34 0:07:31 3:C4_A1   Popping
13:13:43 0:07:39 5:O2_A1   Popping
13:13:46 0:07:40 4:O1_A2   Popping
13:14:03 0:07:52 5:O2_A1   Popping
13:14:05 0:07:53 4:O1_A2   Popping
13:14:10 0:07:58 [PI] O1_A2 poor quality
13:14:18 0:08:03 4:O1_A2   Popping
13:14:18 0:08:03 [PI] EOG_L poor quality
13:14:36 0:08:07 6:EOG_L   Other: saturation
13:14:38 0:08:08 [PI] EOG_R poor quality
13:14:43 0:08:10 4:O1_A2   Popping
13:15:06 0:08:12 7:EOG_R   Other: saturation
13:15:07 0:08:13 [PI] O1_A2 poor quality
13:15:12 0:08:18 [PI] EOG_R poor quality
13:15:16 0:08:19 4:O1_A2   Other: saturation
13:15:32 0:08:22 7:EOG_R   Other: looks like eyes looking
13:15:42 0:08:25 6:EOG_L
13:15:44 0:08:27 [PI] EOG_L poor quality
13:15:51 0:08:28 4:O1_A2   Other: saturation
13:15:51 0:08:28 [PI] EOG_R poor quality
13:16:35 0:08:30 6:EOG_L   Other: looks like eyes looking left not something wrong w/signal
13:16:42 0:08:31 7:EOG_R   Other: eyes looking left
13:16:49 0:08:34 4:O1_A2   Other: saturation
13:16:58 0:08:39 5:O2_A1   Other: saturation
13:16:58 0:08:39 [PI] O2_A1 poor quality

```
13:17:08  0:08:47  5:O2_A1   Flat
13:17:17  0:08:50  4:O1_A2   Popping
13:17:25  0:08:58  [ PI]  O2_A1 poor quality
13:17:30  0:09:00  5:O2_A1   Other: saturation
13:17:52  0:09:06  7:EOG_R   Other: something looks funny...
13:17:54  0:09:07  [ PI]  EOG_R poor quality
13:18:05  0:09:10  7:EOG_R   Other: eyes looking right
13:18:07  0:09:12  [ PI]  EOG_L poor quality
13:18:47  0:09:52  [ PI]  O1_A2 poor quality
13:18:47  0:09:52  [ PI]  O2_A1 poor quality
13:18:53  0:09:54  5:O2_A1   Other: saturation
13:18:58  0:09:56  4:O1_A2   Popping
13:19:18  0:10:16  [ PI]  O2_A1 poor quality
13:19:22  0:10:17  5:O2_A1   Popping
13:19:22  0:10:18  [ PI]  O1_A2 poor quality
13:19:25  0:10:19  2:C3_A2   Popping
13:19:29  0:10:21  4:O1_A2   Popping
13:19:39  0:10:27  5:O2_A1   Other: saturation
13:19:45  0:10:31  4:O1_A2   Other: saturation
13:19:53  0:10:39  [ PI]  O1_A2 poor quality
13:19:54  0:10:40  [ PI]  O2_A1 poor quality
13:20:15  0:10:43  5:O2_A1   Other: saturation
13:20:16  0:10:44  [ PI]  EOG_L poor quality
13:20:16  0:10:44  [ PI]  EOG_R poor quality
13:20:20  0:10:46  4:O1_A2   Popping
13:20:26  0:10:50  5:O2_A1   Popping
13:20:32  0:10:51  6:EOG_L   Other: saturation
13:20:37  0:10:54  7:EOG_R   Other: saturation
13:20:49  0:11:05  4:O1_A2   Popping
13:21:16  0:11:32  [ PI]  O1_A2 poor quality
13:21:20  0:11:34  4:O1_A2   Popping
13:21:25  0:11:36  5:O2_A1   Other: saturation
13:21:30  0:11:39  4:O1_A2   Popping
13:21:54  0:12:04  [ PI]  O1_A2 poor quality
13:21:54  0:12:04  [ PI]  O2_A1 poor quality
13:21:57  0:12:05  5:O2_A1   Other: saturation
13:22:01  0:12:07  4:O1_A2   Popping
13:22:04  0:12:09  [ PI]  EOG_L poor quality
13:22:08  0:12:10  5:O2_A1   Other: saturation
13:22:12  0:12:12  4:O1_A2   Popping
13:22:14  0:12:13  [ PI]  EOG_R poor quality
13:22:23  0:12:15  6:EOG_L   Other: looking right
13:22:39  0:12:27  4:O1_A2   Other: saturation
13:22:54  0:12:42  [ PI]  O2_A1 poor quality
13:22:58  0:12:45  5:O2_A1   Other: saturation
13:23:29  0:13:15  [ PI]  O1_A2 poor quality
13:23:29  0:13:15  [ PI]  O2_A1 poor quality
13:23:33  0:13:18  5:O2_A1   Popping
13:23:37  0:13:19  4:O1_A2   Popping
13:23:37  0:13:19  [ PI]  C4_A1 poor quality
13:23:37  0:13:20  [ PI]  EOG_R poor quality
13:23:43  0:13:23  3:C4_A1   Popping
13:23:50  0:13:26  7:EOG_R   Other: looking right
13:24:00  0:13:36  [ PI]  O2_A1 poor quality
13:24:05  0:13:38  5:O2_A1
13:24:08  0:13:40  5:O2_A1   Popping
13:24:11  0:13:42  [ PI]  O1_A2 poor quality
13:24:15  0:13:45  4:O1_A2   Popping
13:24:20  0:13:50  [ PI]  EOG_R poor quality
13:24:24  0:13:54  [ PI]  O1_A2 poor quality
13:24:31  0:13:59  5:O2_A1   Popping
13:24:33  0:14:00  4:O1_A2   Popping
13:24:40  0:14:05  4:O1_A2   Popping
13:24:55  0:14:17  4:O1_A2   Other: saturation
13:25:08  0:14:24  4:O1_A2   Other: saturaion
13:25:09  0:14:25  [ PI]  O2_A1 poor quality
13:25:14  0:14:28  5:O2_A1   Other: saturation
13:25:18  0:14:30  4:O1_A2   Popping
13:25:21  0:14:33  2:C3_A2   Popping
13:25:28  0:14:37  3:C4_A1   Other: saturation
13:25:34  0:14:41  5:O2_A1   Other: saturation
```

```
13:25:39  0:14:45  4:O1_A2   Popping
13:25:43  0:14:47  2:C3_A2   Popping
13:25:47  0:14:49  5:O2_A1   Popping
13:25:58  0:14:59  5:O2_A1   Popping
13:26:17  0:15:18  [PI]  O1_A2 poor quality
13:26:23  0:15:20  4:O1_A2   Other: saturation
13:26:23  0:15:20  [PI]  O2_A1 poor quality
13:26:25  0:15:22  [PI]  C3_A2 poor quality
13:26:28  0:15:23  5:O2_A1   Popping
13:26:28  0:15:23  [PI]  C4_A1 poor quality
```

sub02111.txt

```
Data file used:   C:/PI/DATAFILE/RICK_6~1.VPD
9:13:09  0:00:19  [PI]  O1_A2 poor quality
9:13:09  0:00:19  [PI]  C4_A1 poor quality
9:13:09  0:00:19  [PI]  O2_A1 poor quality
9:13:35  0:00:22  4:O1_A2   Popping
9:13:45  0:00:24  3:C4_A1   Popping
9:14:01  0:00:26  5:O2_A1   Popping
9:14:09  0:00:34  [PI]  O2_A1 poor quality
9:14:10  0:00:35  [PI]  EKG poor quality
9:14:15  0:00:37  4:O1_A2   Popping
9:14:22  0:00:40  2:C3_A2   Popping
9:14:30  0:00:43  5:O2_A1   Popping
9:14:37  0:00:45  EKG   Noise
9:14:48  0:00:49  4:O1_A2   Flat
9:15:04  0:01:01  EKG   Noise
9:15:18  0:01:08  4:O1_A2   Popping
9:15:22  0:01:12  [PI]  O1_A2 poor quality
9:15:23  0:01:13  [PI]  EKG poor quality
9:15:27  0:01:14  EKG   Noise
9:15:31  0:01:17  [PI]  O2_A1 poor quality
9:15:37  0:01:20  4:O1_A2   Popping
9:15:43  0:01:22  2:C3_A2   Popping
9:15:51  0:01:25  5:O2_A1   Popping
9:16:02  0:01:36  [PI]  O2_A1 poor quality
9:16:03  0:01:37  [PI]  O1_A2 poor quality
9:16:12  0:01:42  4:O1_A2   Popping
9:16:18  0:01:43  5:O2_A1   Flat
9:16:30  0:01:50  4:O1_A2   Flat
9:16:34  0:01:54  [PI]  O1_A2 poor quality
9:16:38  0:01:58  [PI]  O2_A1 poor quality
9:16:45  0:01:59  4:O1_A2   Popping
9:16:51  0:02:02  5:O2_A1   Popping
9:16:56  0:02:08  [PI]  O1_A2 poor quality
9:17:01  0:02:09  4:O1_A2   Popping
9:17:14  0:02:20  4:O1_A2   Popping
9:17:28  0:02:34  [PI]  EKG poor quality
9:17:28  0:02:34  [PI]  O2_A1 poor quality
9:17:40  0:02:40  5:O2_A1   Popping
9:17:45  0:02:41  EKG   Noise
9:17:51  0:02:44  4:O1_A2   Popping
9:17:56  0:02:46  5:O2_A1   Popping
9:18:04  0:02:51  2:C3_A2
9:18:13  0:02:58  5:O2_A1   Popping
9:18:16  0:03:00  [PI]  O2_A1 poor quality
9:18:29  0:03:11  4:O1_A2   Popping
9:18:37  0:03:16  5:O2_A1   Popping
9:18:48  0:03:25  5:O2_A1   Popping
9:18:49  0:03:25  [PI]  EKG poor quality
9:18:54  0:03:26  EKG   Noise
9:18:58  0:03:28  3:C4_A1   Popping
9:18:59  0:03:30  [PI]  O2_A1 poor quality
9:19:04  0:03:32  4:O1_A2   Popping
9:19:04  0:03:32  [PI]  C4_A1 poor quality
9:19:07  0:03:34  2:C3_A2   Popping
9:19:11  0:03:35  3:C4_A1   Popping
9:19:14  0:03:37  5:O2_A1   Popping
9:19:19  0:03:38  EKG   Noise
```

```
9:19:21  0:03:40  [PI]  C3_A2 poor quality
9:19:29  0:03:44  4:O1_A2   Popping
9:19:31  0:03:45  2:C3_A2   Popping
9:19:36  0:03:50  [PI]  O2_A1 poor quality
9:19:44  0:03:54  EKG   Noise
9:19:47  0:03:57  5:O2_A1   Popping
9:19:50  0:03:58  2:C3_A2   Popping
9:19:53  0:03:59  4:O1_A2   Popping
9:20:00  0:04:06  [PI]  O2_A1 poor quality
9:20:04  0:04:08  3:C4_A1   Popping
9:20:07  0:04:10  5:O2_A1   Popping
9:20:31  0:04:33  [PI]  O1_A2 poor quality
9:20:32  0:04:34  [PI]  O2_A1 poor quality
9:20:36  0:04:36  4:O1_A2   Popping
9:20:39  0:04:37  2:C3_A2   Popping
9:20:43  0:04:39  3:C4_A1   Popping
9:20:48  0:04:41  5:O2_A1   Popping
9:20:52  0:04:44  3:C4_A1   Popping
9:21:05  0:04:54  5:O2_A1   Popping
9:21:05  0:04:54  [PI]  O2_A1 poor quality
9:21:10  0:04:58  3:C4_A1   Popping
9:21:18  0:05:05  [PI]  EKG poor quality
9:21:22  0:05:07  EKG   Noise
9:21:28  0:05:11  5:O2_A1
9:21:32  0:05:14  5:O2_A1   Popping
9:21:33  0:05:14  [PI]  O2_A1 poor quality
9:21:36  0:05:15  3:C4_A1   Popping
9:21:39  0:05:17  2:C3_A2   Popping
9:21:48  0:05:24  EKG   Noise
9:21:48  0:05:24  [PI]  C4_A1 poor quality
9:21:49  0:05:25  [PI]  C3_A2 poor quality
9:21:53  0:05:28  4:O1_A2   Popping
9:21:56  0:05:29  2:C3_A2   Popping
9:21:59  0:05:31  3:C4_A1   Popping
9:22:02  0:05:32  5:O2_A1   Popping
9:22:10  0:05:38  5:O2_A1   Popping
9:22:13  0:05:39  3:C4_A1   Popping
9:22:43  0:06:07  5:O2_A1   Popping
9:22:55  0:06:16  EKG   Noise
9:23:18  0:06:36  5:O2_A1   Popping
9:23:26  0:06:42  EKG   Noise
9:23:28  0:06:43  [PI]  O1_A2 poor quality
9:23:34  0:06:48  4:O1_A2   Popping
9:23:40  0:06:51  5:O2_A1   Popping
9:23:47  0:06:58  [PI]  C3_A2 poor quality
9:23:50  0:07:00  2:C3_A2   Popping
9:23:53  0:07:01  3:C4_A1   Popping
9:23:56  0:07:02  4:O1_A2   Popping
9:23:57  0:07:02  [PI]  EOG_L poor quality
9:24:03  0:07:06  4:O1_A2   Popping
9:24:06  0:07:07  2:C3_A2   Popping
9:24:14  0:07:08  6:EOG_L   Popping
9:24:24  0:07:09  7:EOG_R   Popping
9:24:29  0:07:12  2:C3_A2   Popping
9:24:31  0:07:14  [PI]  O1_A2 poor quality
9:24:37  0:07:19  4:O1_A2   Popping
9:24:40  0:07:20  2:C3_A2   Popping
9:24:49  0:07:29  [PI]  O1_A2 poor quality
9:24:50  0:07:30  [PI]  O2_A1 poor quality
9:24:53  0:07:31  EKG   Noise
9:24:56  0:07:32  5:O2_A1   Popping
9:24:59  0:07:34  3:C4_A1   Popping
9:25:02  0:07:35  2:C3_A2   Popping
9:25:04  0:07:37  4:O1_A2   Popping
9:25:19  0:07:50  2:C3_A2   Popping
9:25:28  0:07:58  [PI]  O1_A2 poor quality
9:25:30  0:07:59  4:O1_A2   Popping
9:25:34  0:08:03  [PI]  EOG_L poor quality
9:25:40  0:08:06  6:EOG_L   Flat
9:25:43  0:08:08  [PI]  EOG_R poor quality
9:25:48  0:08:11  7:EOG_R
```

```
9:25:50  0:08:13  [ PI]  O1_A2 poor quality
9:25:55  0:08:18  [ PI]  EOG_R poor quality
9:26:03  0:08:20  7:EOG_R   Flat
9:26:08  0:08:23  6:EOG_L   Flat
9:26:12  0:08:27  [ PI]  EOG_L poor quality
9:26:13  0:08:28  [ PI]  EOG_R poor quality
9:26:24  0:08:31  4:O1_A2   Popping
9:26:27  0:08:33  6:EOG_L   Flat
9:26:31  0:08:34  7:EOG_R   Flat
9:26:36  0:08:38  4:O1_A2   Popping
9:26:38  0:08:39  [ PI]  O2_A1 poor quality
9:26:40  0:08:40  5:O2_A1   Popping
9:26:45  0:08:43  3:C4_A1   Popping
9:26:49  0:08:46  5:O2_A1   Flat
9:27:02  0:08:58  [ PI]  O2_A1 poor quality
9:27:09  0:09:00  5:O2_A1   Flat
9:27:16  0:09:07  [ PI]  EOG_R poor quality
9:27:21  0:09:12  [ PI]  EOG_L poor quality
9:28:01  0:09:52  [ PI]  O1_A2 poor quality
9:28:01  0:09:52  [ PI]  O2_A1 poor quality
9:28:05  0:09:54  4:O1_A2   Popping
9:28:08  0:09:55  5:O2_A1   Flat
9:28:16  0:10:02  4:O1_A2   Popping
9:28:30  0:10:16  [ PI]  O2_A1 poor quality
9:28:34  0:10:18  5:O2_A1   Popping
9:28:34  0:10:18  [ PI]  O1_A2 poor quality
9:28:36  0:10:19  3:C4_A1   Popping
9:28:39  0:10:20  2:C3_A2   Popping
9:28:42  0:10:22  4:O1_A2   Popping
9:28:50  0:10:27  5:O2_A1   Flat
9:28:55  0:10:31  4:O1_A2   Popping
9:29:03  0:10:39  [ PI]  O1_A2 poor quality
9:29:04  0:10:40  [ PI]  O2_A1 poor quality
9:29:11  0:10:44  4:O1_A2   Popping
9:29:11  0:10:44  [ PI]  EOG_L poor quality
9:29:11  0:10:44  [ PI]  EOG_R poor quality
9:29:18  0:10:46  5:O2_A1   Flat
9:29:21  0:10:48  6:EOG_L   Flat
9:29:25  0:10:49  7:EOG_R   Flat
9:29:31  0:10:53  5:O2_A1   Popping
9:29:45  0:11:05  4:O1_A2   Popping
9:30:12  0:11:32  [ PI]  O1_A2 poor quality
9:30:16  0:11:34  4:O1_A2   Popping
9:30:22  0:11:36  5:O2_A1   Popping
9:30:25  0:11:38  2:C3_A2   Popping
9:30:55  0:12:04  5:O2_A1   Popping
9:30:55  0:12:04  [ PI]  O1_A2 poor quality
9:30:55  0:12:04  [ PI]  O2_A1 poor quality
9:30:58  0:12:05  4:O1_A2   Popping
9:31:02  0:12:09  [ PI]  EOG_L poor quality
9:31:06  0:12:13  [ PI]  EOG_R poor quality
9:31:12  0:12:17  5:O2_A1   Popping
9:31:24  0:12:27  5:O2_A1   Popping
9:31:31  0:12:28  4:O1_A2   Popping
9:31:44  0:12:42  [ PI]  O2_A1 poor quality
9:31:54  0:12:44  5:O2_A1   Flat
9:32:25  0:13:15  [ PI]  O1_A2 poor quality
9:32:25  0:13:15  [ PI]  O2_A1 poor quality
9:32:28  0:13:16  4:O1_A2   Popping
9:32:32  0:13:18  5:O2_A1   Popping
9:32:33  0:13:19  [ PI]  C4_A1 poor quality
9:32:36  0:13:20  3:C4_A1   Popping
9:32:36  0:13:20  [ PI]  EOG_R poor quality
9:32:38  0:13:22  2:C3_A2   Popping
9:32:43  0:13:24  7:EOG_R
9:32:55  0:13:36  [ PI]  O2_A1 poor quality
9:32:58  0:13:37  5:O2_A1   Popping
9:33:01  0:13:39  4:O1_A2   Popping
9:33:05  0:13:42  [ PI]  O1_A2 poor quality
9:33:08  0:13:44  4:O1_A2   Popping
9:33:12  0:13:45  5:O2_A1   Popping
```

```
9:33:16  0:13:47  3:C4_A1   Popping
9:33:20  0:13:50  [PI]  EOG_R poor quality
9:33:25  0:13:54  7:EOG_R   Flat
9:33:25  0:13:54  [PI]  O1_A2 poor quality
9:33:30  0:13:57  4:O1_A2   Popping
9:33:33  0:13:58  5:O2_A1   Popping
9:33:37  0:14:00  3:C4_A1   Popping
9:33:40  0:14:01  2:C3_A2   Popping
9:33:47  0:14:06  4:O1_A2   Popping
9:33:52  0:14:10  4:O1_A2   Popping
9:33:55  0:14:11  2:C3_A2   Popping
9:33:58  0:14:13  3:C4_A1   Popping
9:34:01  0:14:14  5:O2_A1   Popping
9:34:10  0:14:21  4:O1_A2   Popping
9:34:12  0:14:22  2:C3_A2   Popping
9:34:15  0:14:23  3:C4_A1   Popping
9:34:18  0:14:25  5:O2_A1   Popping
9:34:19  0:14:25  [PI]  O2_A1 poor quality
9:34:30  0:14:35  4:O1_A2   Popping
9:34:33  0:14:36  2:C3_A2   Popping
9:34:36  0:14:38  3:C4_A1   Popping
9:34:39  0:14:39  5:O2_A1   Popping
9:34:46  0:14:45  4:O1_A2   Popping
9:34:48  0:14:47  2:C3_A2   Popping
9:34:51  0:14:48  3:C4_A1   Popping
9:34:54  0:14:49  5:O2_A1   Popping
9:35:06  0:14:59  EKG   Noise
9:35:12  0:15:01  5:O2_A1   Popping
9:35:32  0:15:18  5:O2_A1   Popping
9:35:32  0:15:18  [PI]  O1_A2 poor quality
9:35:36  0:15:20  4:O1_A2   Popping
9:35:36  0:15:20  [PI]  O2_A1 poor quality
9:35:37  0:15:22  [PI]  C3_A2 poor quality
9:35:40  0:15:23  4:O1_A2   Popping
9:35:40  0:15:23  [PI]  C4_A1 poor quality
9:35:43  0:15:24  2:C3_A2   Popping
9:35:45  0:15:25  3:C4_A1   Popping
9:35:48  0:15:26  5:O2_A1   Popping
9:35:51  0:15:26  EKG   Noise
```

sub02120.txt

```
9:08:45  0:00:03  4:O1_A2   Popping
9:08:50  0:00:05  2:C3_A2   Popping
9:08:54  0:00:07  3:C4_A1   Popping
9:08:58  0:00:08  5:O2_A1   Popping
9:09:05  0:00:10  10:EMGlsm   Flat
9:09:10  0:00:12  EKG   Noise
9:09:12  0:00:13  4:O1_A2   Popping
9:09:16  0:00:16  2:C3_A2   Popping
9:09:19  0:00:17  3:C4_A1   Popping
9:09:24  0:00:19  5:O2_A1   Popping
9:09:24  0:00:19  [PI]  O1_A2 poor quality
9:09:24  0:00:19  [PI]  C4_A1 poor quality
9:09:24  0:00:19  [PI]  O2_A1 poor quality
9:09:30  0:00:24  4:O1_A2   Popping
9:09:42  0:00:34  3:C4_A1   Popping
9:09:42  0:00:34  [PI]  O2_A1 poor quality
9:09:42  0:00:35  [PI]  EKG poor quality
9:09:45  0:00:37  5:O2_A1   Popping
9:09:50  0:00:39  2:C3_A2   Popping
9:09:53  0:00:40  4:O1_A2   Popping
9:09:58  0:00:41  EKG   Noise
9:10:06  0:00:46  4:O1_A2   Popping
9:10:09  0:00:48  2:C3_A2   Popping
9:10:16  0:00:53  4:O1_A2   Popping
9:10:22  0:00:57  EKG   Noise
9:10:26  0:00:59  4:O1_A2   Popping
9:10:35  0:01:06  4:O1_A2   Popping
9:10:39  0:01:08  EKG   Noise
```

```
9:10:43  0:01:12  [ PI]  O1_A2 poor quality
9:10:44  0:01:13  [ PI]  EKG poor quality
9:10:49  0:01:17  4:O1_A2   Popping
9:10:49  0:01:17  [ PI]  O2_A1 poor quality
9:10:52  0:01:18  2:C3_A2   Popping
9:10:54  0:01:19  3:C4_A1   Popping
9:10:58  0:01:21  5:O2_A1   Popping
9:11:02  0:01:22  EKG   Noise
9:11:12  0:01:27  6:EOG_L   Flat
9:11:15  0:01:29  7:EOG_R   Flat
9:11:19  0:01:30  4:O1_A2   Popping
9:11:23  0:01:33  5:O2_A1   Popping
9:11:27  0:01:36  [ PI]  O2_A1 poor quality
9:11:28  0:01:37  [ PI]  O1_A2 poor quality
9:11:31  0:01:39  4:O1_A2   Popping
9:11:35  0:01:41  5:O2_A1   Flat
9:11:44  0:01:47  4:O1_A2   Popping
9:11:50  0:01:54  [ PI]  O1_A2 poor quality
9:11:53  0:01:56  4:O1_A2   Popping
9:11:56  0:01:58  2:C3_A2   Popping
9:11:56  0:01:58  [ PI]  O2_A1 poor quality
9:11:59  0:01:59  3:C4_A1   Popping
9:12:02  0:02:00  5:O2_A1   Popping
9:12:05  0:02:01  EKG   Noise
9:12:13  0:02:08  4:O1_A2   Popping
9:12:13  0:02:08  [ PI]  O1_A2 poor quality
9:12:16  0:02:10  2:C3_A2   Popping
9:12:20  0:02:11  3:C4_A1   Popping
9:12:23  0:02:13  5:O2_A1   Popping
9:12:34  0:02:22  4:O1_A2   Popping
9:12:41  0:02:28  4:O1_A2   Popping
9:12:45  0:02:30  3:C4_A1   Popping
9:12:48  0:02:31  5:O2_A1   Popping
9:12:53  0:02:34  4:O1_A2   Popping
9:12:53  0:02:34  [ PI]  EKG poor quality
9:12:54  0:02:34  [ PI]  O2_A1 poor quality
9:12:57  0:02:35  EKG   Noise
9:13:00  0:02:37  5:O2_A1   Popping
9:13:03  0:02:39  3:C4_A1   Popping
9:13:06  0:02:40  2:C3_A2   Popping
9:13:15  0:02:48  4:O1_A2   Popping
9:13:18  0:02:49  EKG   Noise
9:13:21  0:02:50  5:O2_A1   Popping
9:13:24  0:02:51  3:C4_A1   Popping
9:13:26  0:02:52  2:C3_A2   Popping
9:13:33  0:02:57  4:O1_A2   Popping
9:13:37  0:03:00  5:O2_A1   Popping
9:13:38  0:03:00  [ PI]  O2_A1 poor quality
9:13:41  0:03:02  EKG   Noise
9:13:44  0:03:04  4:O1_A2   Popping
9:13:47  0:03:05  2:C3_A2   Popping
9:13:49  0:03:06  3:C4_A1   Popping
9:13:53  0:03:07  5:O2_A1   Popping
9:14:01  0:03:14  4:O1_A2   Popping
9:14:05  0:03:16  3:C4_A1   Popping
9:14:08  0:03:18  5:O2_A1   Popping
9:14:15  0:03:23  EKG   Noise
9:14:17  0:03:25  [ PI]  EKG poor quality
9:14:25  0:03:30  4:O1_A2   Popping
9:14:25  0:03:30  [ PI]  O2_A1 poor quality
9:14:28  0:03:32  2:C3_A2   Popping
9:14:29  0:03:32  [ PI]  C4_A1 poor quality
9:14:31  0:03:34  3:C4_A1   Popping
9:14:36  0:03:35  5:O2_A1   Popping
9:14:39  0:03:38  EKG   Noise
9:14:41  0:03:40  [ PI]  C3_A2 poor quality
9:14:52  0:03:50  [ PI]  O2_A1 poor quality
9:14:55  0:03:52  2:C3_A2   Popping
9:14:57  0:03:53  3:C4_A1   Popping
9:15:01  0:03:54  5:O2_A1   Popping
9:15:12  0:04:04  4:O1_A2   Flat
```

```
9:15:15  0:04:06  [PI]  O2_A1 poor quality
9:15:17  0:04:07  4:O1_A2   Popping
9:15:20  0:04:08  2:C3_A2   Popping
9:15:23  0:04:09  3:C4_A1   Popping
9:15:27  0:04:11  5:O2_A1   Popping
9:15:35  0:04:17  4:O1_A2   Popping
9:15:38  0:04:20  3:C4_A1   Popping
9:15:42  0:04:21  5:O2_A1   Popping
9:15:53  0:04:33  [PI]  O1_A2 poor quality
9:15:54  0:04:34  [PI]  O2_A1 poor quality
9:15:57  0:04:35  4:O1_A2   Popping
9:16:00  0:04:36  2:C3_A2   Popping
9:16:03  0:04:37  3:C4_A1   Popping
9:16:06  0:04:39  5:O2_A1   Popping
9:16:22  0:04:53  4:O1_A2   Popping
9:16:24  0:04:54  2:C3_A2   Popping
9:16:25  0:04:54  [PI]  O2_A1 poor quality
9:16:27  0:04:56  3:C4_A1   Popping
9:16:30  0:04:57  5:O2_A1   Popping
9:16:37  0:05:05  [PI]  EKG poor quality
9:16:42  0:05:08  4:O1_A2   Popping
9:16:46  0:05:11  5:O2_A1   Popping
9:16:48  0:05:12  3:C4_A1   Popping
9:16:51  0:05:14  2:C3_A2   Popping
9:16:51  0:05:14  [PI]  O2_A1 poor quality
9:16:54  0:05:15  EKG   Noise
9:17:03  0:05:24  [PI]  C4_A1 poor quality
9:17:04  0:05:25  [PI]  C3_A2 poor quality
9:17:16  0:05:36  4:O1_A2   Popping
9:17:19  0:05:37  2:C3_A2   Popping
9:17:22  0:05:39  3:C4_A1   Popping
9:17:25  0:05:40  5:O2_A1   Popping
9:17:35  0:05:49  4:O1_A2   Popping
9:17:44  0:05:54  2:C3_A2
9:17:49  0:05:57  EKG   Noise
9:17:58  0:06:04  4:O1_A2   Popping
9:18:01  0:06:06  5:O2_A1   Popping
9:18:12  0:06:14  3:C4_A1   Popping
9:18:16  0:06:17  4:O1_A2   Popping
9:18:20  0:06:19  EKG   Noise
9:18:28  0:06:25  4:O1_A2   Popping
9:18:39  0:06:34  5:O2_A1   Popping
9:18:48  0:06:41  EKG   Noise
9:18:51  0:06:43  [PI]  O1_A2 poor quality
9:18:57  0:06:47  4:O1_A2   Popping
9:19:08  0:06:58  [PI]  C3_A2 poor quality
9:19:12  0:06:59  2:C3_A2   Popping
9:19:17  0:07:01  3:C4_A1   Popping
9:19:18  0:07:02  [PI]  EOG_L poor quality
9:19:27  0:07:06  6:EOG_L   Popping
9:19:34  0:07:08  7:EOG_R   Popping
9:19:38  0:07:11  3:C4_A1   Popping
9:19:42  0:07:14  2:C3_A2   Popping
9:19:42  0:07:14  [PI]  O1_A2 poor quality
9:19:45  0:07:15  4:O1_A2   Popping
9:19:59  0:07:29  [PI]  O1_A2 poor quality
9:20:00  0:07:30  [PI]  O2_A1 poor quality
9:20:02  0:07:31  4:O1_A2   Popping
9:20:07  0:07:34  2:C3_A2   Popping
9:20:10  0:07:35  3:C4_A1   Popping
9:20:14  0:07:37  5:O2_A1   Popping
9:20:18  0:07:39  EKG
9:20:28  0:07:47  5:O2_A1   Popping
9:20:31  0:07:49  2:C3_A2   Popping
9:20:34  0:07:51  4:O1_A2   Popping
9:20:42  0:07:58  [PI]  O1_A2 poor quality
9:20:46  0:08:01  4:O1_A2   Popping
9:20:49  0:08:02  2:C3_A2   Popping
9:20:50  0:08:03  [PI]  EOG_L poor quality
9:20:54  0:08:06  5:O2_A1   Popping
9:20:56  0:08:08  [PI]  EOG_R poor quality
```

```
9:21:01  0:08:13  [ PI]  O1_A2 poor quality
9:21:07  0:08:16  4:O1_A2   Popping
9:21:09  0:08:18  [ PI]  EOG_R poor quality
9:21:14  0:08:22  2:C3_A2   Poppıng
9:21:17  0:08:23  4:O1_A2   Poppıng
9:21:21  0:08:27  [ PI]  EOG_L poor qualıty
9:21:22  0:08:28  [ PI]  EOG_R poor quality
9:21:34  0:08:34  5:O2_A1   Popping
9:21:37  0:08:36  6:EOG_L   Flat
9:21:40  0:08:37  7:EOG_R   Flat
9:21:42  0:08:39  [ PI]  O2_A1 poor quality
9:21:46  0:08:41  5:O2_A1   Popping
9:21:49  0:08:43  3:C4_A1   Popping
9:21:52  0:08:45  4:O1_A2   Popping
9:21:57  0:08:48  5:O2_A1   Flat
9:22:08  0:08:56  4:O1_A2   Popping
9:22:10  0:08:58  [ PI]  O2_A1 poor quality
9:22:15  0:09:00  5:O2_A1   Flat
9:22:19  0:09:02  7:EOG_R   Popping
9:22:24  0:09:07  [ PI]  EOG_R poor quality
9:22:29  0:09:12  [ PI]  EOG_L poor qualıty
9:22:33  0:09:14  5:O2_A1   Popping
9:23:11  0:09:52  [ PI]  O1_A2 poor quality
9:23:11  0:09:52  [ PI]  O2_A1 poor quality
9:23:14  0:09:53  4:O1_A2   Popping
9:23:18  0:09:55  5:O2_A1   Poppıng
9:23:22  0:09:56  3:C4_A1   Poppıng
9:23:43  0:10:16  5:O2_A1   Popping
9:23:43  0:10:16  [ PI]  O2_A1 poor quality
9:23:45  0:10:18  3:C4_A1   Popping
9:23:45  0:10:18  [ PI]  O1_A2 poor quality
9:23:47  0:10:19  2:C3_A2   Popping
9:23:50  0:10:20  4:O1_A2   Popping
9:23:57  0:10:27  5:O2_A1   Flat
9:24:02  0:10:29  4:O1_A2   Popping
9:24:12  0:10:39  [ PI]  O1_A2 poor quality
9:24:13  0:10:40  [ PI]  O2_A1 poor quality
9:24:18  0:10:43  4:O1_A2   Poppıng
9:24:21  0:10:44  2:C3_A2   Popping
9:24:21  0:10:44  [ PI]  EOG_L poor quality
9:24:21  0:10:44  [ PI]  EOG_R poor quality
9:24:24  0:10:46  3:C4_A1   Popping
9:24:28  0:10:48  5:O2_A1   Popping
9:24:36  0:10:56  4:O1_A2   Popping
9:24:38  0:10:57  2:C3_A2   Popping
9:24:41  0:10:58  3:C4_A1   Popping
9:24:43  0:10:59  5:O2_A1   Popping
9:24:57  0:11:11  4:O1_A2   Popping
9:25:00  0:11:13  5:O2_A1   Popping
9:25:18  0:11:32  [ PI]  O1_A2 poor quality
9:25:21  0:11:33  4:O1_A2   Popping
9:25:24  0:11:35  2:C3_A2   Popping
9:25:27  0:11:36  3:C4_A1   Popping
9:25:29  0:11:37  5:O2_A1   Popping
9:25:56  0:12:04  [ PI]  O1_A2 poor quality
9:25:56  0:12:04  [ PI]  O2_A1 poor quality
9:25:59  0:12:05  5:O2_A1   Popping
9:26:03  0:12:07  4:O1_A2   Popping
9:26:06  0:12:08  3:C4_A1   Popping
9:26:07  0:12:09  [ PI]  EOG_L poor quality
9:26:11  0:12:13  [ PI]  EOG_R poor quality
9:26:26  0:12:26  4:O1_A2   Popping
9:26:28  0:12:27  5:O2_A1   Popping
9:26:44  0:12:42  [ PI]  O2_A1 poor quality
9:26:47  0:12:44  5:O2_A1   Flat
9:27:19  0:13:15  [ PI]  O1_A2 poor qualıty
9:27:19  0:13:15  [ PI]  O2_A1 poor qualıty
9:27:23  0:13:17  4:O1_A2   Popping
9:27:26  0:13:19  2:C3_A2   Popping
9:27:26  0:13:19  [ PI]  C4_A1 poor quality
9:27:28  0:13:20  3:C4_A1   Popping
```

```
9:27:29  0:13:20  [ PI]  EOG_R poor quality
9:27:32  0:13:21  5:O2_A1   Popping
9:27:37  0:13:26  EKG   Noise
9:27:46  0:13:33  5:O2_A1   Popping
9:27:49  0:13:36  [ PI]  O2_A1 poor quality
9:27:52  0:13:38  5:O2_A1   Popping
9:27:54  0:13:39  4:O1_A2   Popping
9:27:58  0:13:42  [ PI]  O1_A2 poor quality
9:28:01  0:13:44  4:O1_A2   Popping
9:28:05  0:13:46  2:C3_A2   Popping
9:28:09  0:13:47  3:C4_A1   Popping
9:28:12  0:13:49  5:O2_A1   Popping
9:28:13  0:13:50  [ PI]  EOG_R poor quality
9:28:17  0:13:54  [ PI]  O1_A2 poor quality
9:28:25  0:14:00  4:O1_A2   Popping
9:28:27  0:14:01  2:C3_A2   Popping
9:28:29  0:14:02  3:C4_A1   Popping
9:28:31  0:14:03  5:O2_A1   Popping
9:28:39  0:14:08  EKG   Noise
9:28:47  0:14:16  4:O1_A2   Popping
9:28:52  0:14:20  5:O2_A1   Popping
9:28:55  0:14:21  3:C4_A1   Popping
9:28:57  0:14:22  2:C3_A2   Popping
9:29:01  0:14:25  4:O1_A2   Popping
9:29:01  0:14:25  [ PI]  O2_A1 poor quality
9:29:07  0:14:28  EKG   Noise
9:29:12  0:14:32  4:O1_A2   Popping
9:29:15  0:14:33  2:C3_A2   Popping
9:29:17  0:14:34  3:C4_A1   Popping
9:29:20  0:14:35  5:O2_A1   Popping
9:29:33  0:14:45  4:O1_A2   Popping
9:29:35  0:14:46  2:C3_A2   Popping
9:29:37  0:14:47  3:C4_A1   Popping
9:29:41  0:14:49  5:O2_A1   Popping
9:29:51  0:14:57  EKG   Noise
9:30:00  0:15:04  5:O2_A1   Popping
9:30:15  0:15:18  5:O2_A1   Popping
9:30:15  0:15:18  [ PI]  O1_A2 poor quality
9:30:17  0:15:19  2:C3_A2   Popping
9:30:21  0:15:20  4:O1_A2   Popping
9:30:21  0:15:20  [ PI]  O2_A1 poor quality
9:30:22  0:15:22  [ PI]  C3_A2 poor quality
9:30:25  0:15:23  EKG   Noise
9:30:25  0:15:23  [ PI]  C4_A1 poor quality
9:30:27  0:15:24  5:O2_A1   Popping
9:30:29  0:15:26  3:C4_A1   Popping
9:30:32  0:15:26  2:C3_A2   Popping
9:30:35  0:15:26  4:O1_A2   Popping
```

sub03110.txt

```
12:15:04  0:00:16  4:O1_A2   Popping
12:15:09  0:00:19  2:C3_A2   Popping
12:15:09  0:00:19  [ PI]  O1_A2 poor quality
12:15:09  0:00:19  [ PI]  C4_A1 poor quality
12:15:09  0:00:19  [ PI]  O2_A1 poor quality
12:15:13  0:00:21  3:C4_A1   Popping
12:15:19  0:00:24  5:O2_A1   Popping
12:15:26  0:00:29  EKG   Noise
12:15:32  0:00:34  [ PI]  O2_A1 poor quality
12:15:33  0:00:35  [ PI]  EKG poor quality
12:15:51  0:00:50  4:O1_A2   Flat
12:16:02  0:00:58  EKG   Noise
12:16:16  0:01:12  [ PI]  O1_A2 poor quality
12:16:17  0:01:13  [ PI]  EKG poor quality
12:16:21  0:01:17  [ PI]  O2_A1 poor quality
12:16:27  0:01:21  EKG   Noise
12:16:43  0:01:36  [ PI]  O2_A1 poor quality
12:16:44  0:01:37  [ PI]  O1_A2 poor quality
12:16:59  0:01:40  4:O1_A2   Noise
```

```
12:17:02  0:01:41  2:C3_A2   Noise
12:17:16  0:01:54  [PI]  O1_A2 poor quality
12:17:21  0:01:57  4:O1_A2   Popping
12:17:21  0:01:58  [PI]  O2_A1 poor quality
12:17:25  0:02:00  2:C3_A2   Popping
12:17:29  0:02:02  EKG   Noise
12:17:35  0:02:08  [PI]  O1_A2 poor quality
12:18:01  0:02:34  [PI]  EKG poor quality
12:18:01  0:02:34  [PI]  O2_A1 poor quality
12:18:08  0:02:39  EKG   Noise
12:18:22  0:02:50  EKG   Noise
12:18:34  0:02:59  4:O1_A2   Popping
12:18:35  0:03:00  [PI]  O2_A1 poor quality
12:18:51  0:03:15  5:O2_A1   Popping
12:18:57  0:03:19  3:C4_A1   Popping
12:19:04  0:03:25  [PI]  EKG poor quality
12:19:08  0:03:28  EKG   Popping
12:19:10  0:03:30  [PI]  O2_A1 poor quality
12:19:12  0:03:32  [PI]  C4_A1 poor quality
12:19:20  0:03:40  [PI]  C3_A2 poor quality
12:19:26  0:03:43  4:O1_A2   Flat
12:19:33  0:03:50  [PI]  O2_A1 poor quality
12:19:49  0:04:06  [PI]  O2_A1 poor quality
12:20:00  0:04:15  10:EMGlsm   Noise
12:20:05  0:04:16  11:EMGrsm   Noise
12:20:23  0:04:32  4:O1_A2   Noise
12:20:29  0:04:33  2:C3_A2   Noise
12:20:29  0:04:33  [PI]  O1_A2 poor quality
12:20:29  0:04:34  [PI]  O2_A1 poor quality
12:20:33  0:04:37  4:O1_A2   Popping
12:20:38  0:04:39  2:C3_A2   Popping
12:20:41  0:04:40  3:C4_A1   Popping
12:20:45  0:04:42  5:O2_A1   Popping
12:20:51  0:04:47  7:EOG_R   Flat
12:20:58  0:04:54  [PI]  O2_A1 poor quality
12:21:02  0:04:57  4:O1_A2   Flat
12:21:11  0:05:04  10:EMGlsm   Noise
12:21:15  0:05:05  4:O1_A2   Noise
12:21:15  0:05:05  [PI]  EKG poor quality
12:21:18  0:05:07  2:C3_A2   Noise
12:21:23  0:05:11  4:O1_A2   Popping
12:21:26  0:05:12  2:C3_A2   Popping
12:21:30  0:05:14  EKG   Noise
12:21:30  0:05:14  [PI]  O2_A1 poor quality
12:21:40  0:05:24  [PI]  C4_A1 poor quality
12:21:41  0:05:25  [PI]  C3_A2 poor quality
12:21:58  0:05:39  4:O1_A2   Popping
12:22:00  0:05:40  2:C3_A2   Popping
12:22:05  0:05:43  3:C4_A1   Popping
12:22:07  0:05:44  5:O2_A1   Popping
12:22:18  0:05:51  10:EMGlsm   Noise
12:22:23  0:05:53  11:EMGrsm   Noise
12:22:28  0:05:55  4:O1_A2   Flat
12:22:35  0:06:01  2:C3_A2   Noise
12:22:46  0:06:10  10:EMGlsm   Noise
12:22:49  0:06:11  11:EMGrsm   Noise
12:23:22  0:06:41  4:O1_A2   Noise
12:23:28  0:06:42  2:C3_A2   Noise
12:23:28  0:06:43  [PI]  O1_A2 poor quality
12:23:45  0:06:57  6:EOG_L   Noise
12:23:46  0:06:58  [PI]  C3_A2 poor quality
12:23:50  0:07:02  [PI]  EOG_L poor quality
12:23:56  0:07:05  2:C3_A2   Popping
12:24:01  0:07:07  3:C4_A1   Popping
12:24:05  0:07:09  6:EOG_L   Popping
12:24:09  0:07:12  7:EOG_R   Popping
12:24:11  0:07:14  [PI]  O1_A2 poor quality
12:24:17  0:07:19  4:O1_A2   Noise
12:24:21  0:07:20  2:C3_A2   Noise
12:24:25  0:07:22  11:EMGrsm   Noise
12:24:33  0:07:29  [PI]  O1_A2 poor quality
```

```
12:24:35  0:07:30  6:EOG_L   Noise
12:24:36  0:07:30  [ PI]  O2_A1 poor quality
12:24:40  0:07:32  EKG   Noise
12:24:59  0:07:49  5:O2_A1   Flat
12:25:08  0:07:56  4:O1_A2   Noise
12:25:12  0:07:58  2:C3_A2   Noise
12:25:12  0:07:58  [ PI]  O1_A2 poor quality
12:25:17  0:08:03  [ PI]  EOG_L poor quality
12:25:25  0:08:08  4:O1_A2   Popping
12:25:25  0:08:08  [ PI]  EOG_R poor quality
12:25:29  0:08:13  [ PI]  O1_A2 poor quality
12:25:34  0:08:18  [ PI]  EOG_R poor quality
12:25:42  0:08:24  4:O1_A2   Flat
12:25:45  0:08:27  [ PI]  EOG_L poor quality
12:25:46  0:08:28  [ PI]  EOG_R poor quality
12:25:51  0:08:30  11:EMGrsm   Popping
12:25:56  0:08:31  10:EMGlsm   Noise
12:26:02  0:08:36  2:C3_A2   Noise
12:26:06  0:08:38  4:O1_A2   Noise
12:26:07  0:08:39  [ PI]  O2_A1 poor quality
12:26:22  0:08:52  5:O2_A1   Flat
12:26:28  0:08:58  [ PI]  O2_A1 poor quality
12:26:36  0:09:04  7:EOG_R   Popping
12:26:39  0:09:07  [ PI]  EOG_R poor quality
12:26:42  0:09:08  4:O1_A2   Noise
12:26:47  0:09:09  2:C3_A2   Noise
12:26:51  0:09:12  [ PI]  EOG_L poor quality
12:26:56  0:09:15  3:C4_A1   Noise
12:27:01  0:09:18  10:EMGlsm   Noise
12:27:04  0:09:20  11:EMGrsm   Noise
12:27:14  0:09:26  6:EOG_L   Noise
12:27:41  0:09:52  [ PI]  O1_A2 poor quality
12:27:41  0:09:52  [ PI]  O2_A1 poor quality
12:27:47  0:09:55  4:O1_A2   Popping
12:27:50  0:09:56  5:O2_A1   Flat
12:27:56  0:10:00  4:O1_A2   Noise
12:28:07  0:10:09  6:EOG_L   Noise
12:28:15  0:10:16  [ PI]  O2_A1 poor quality
12:28:17  0:10:17  5:O2_A1   Popping
12:28:19  0:10:18  [ PI]  O1_A2 poor quality
12:28:21  0:10:19  3:C4_A1   Popping
12:28:25  0:10:20  2:C3_A2   Popping
12:28:29  0:10:21  4:O1_A2   Popping
12:28:35  0:10:26  4:O1_A2   Noise
12:28:39  0:10:27  2:C3_A2   Noise
12:28:44  0:10:30  5:O2_A1   Flat
12:28:53  0:10:39  [ PI]  O1_A2 poor quality
12:28:54  0:10:40  [ PI]  O2_A1 poor quality
12:28:59  0:10:43  4:O1_A2   Popping
12:28:59  0:10:44  [ PI]  EOG_L poor quality
12:29:00  0:10:44  [ PI]  EOG_R poor quality
12:29:06  0:10:47  5:O2_A1   Flat
12:29:09  0:10:50  6:EOG_L   Flat
12:29:19  0:10:56  4:O1_A2   Popping
12:29:22  0:10:58  2:C3_A2   Popping
12:29:25  0:11:00  3:C4_A1   Popping
12:29:28  0:11:01  5:O2_A1   Popping
12:29:42  0:11:14  4:O1_A2   Noise
12:29:46  0:11:15  2:C3_A2   Noise
12:30:02  0:11:32  [ PI]  O1_A2 poor quality
12:30:06  0:11:34  4:O1_A2   Popping
12:30:10  0:11:37  3:C4_A1   Popping
12:30:13  0:11:38  5:O2_A1   Popping
12:30:16  0:11:40  2:C3_A2   Popping
12:30:29  0:11:51  6:EOG_L   Noise
12:30:32  0:11:52  4:O1_A2   Noise
12:30:35  0:11:53  2:C3_A2   Noise
12:30:45  0:12:04  [ PI]  O1_A2 poor quality
12:30:45  0:12:04  [ PI]  O2_A1 poor quality
12:30:53  0:12:09  4:O1_A2   Popping
12:30:53  0:12:09  [ PI]  EOG_L poor quality
```

```
12:30:56  0:12:11  2:C3_A2   Popping
12:30:59  0:12:12  3:C4_A1   Popping
12:31:01  0:12:13  [ PI]  EOG_R poor quality
12:31:02  0:12:14  5:O2_A1   Popping
12:31:06  0:12:16  4:O1_A2   Noise
12:31:09  0:12:17  2:C3_A2   Noise
12:31:22  0:12:25  10:EMGlsm   Noise
12:31:26  0:12:27  11:EMGrsm   Noise
12:31:41  0:12:42  [ PI]  O2_A1 poor quality
12:31:45  0:12:44  5:O2_A1   Flat
12:32:16  0:13:15  [ PI]  O1_A2 poor quality
12:32:16  0:13:15  [ PI]  O2_A1 poor quality
12:32:21  0:13:18  4:O1_A2   Popping
12:32:22  0:13:19  [ PI]  C4_A1 poor quality
12:32:24  0:13:20  2:C3_A2   Poppıng
12:32:25  0:13:20  [ PI]  EOG_R poor quality
12:32:27  0:13:21  3:C4_A1   Poppıng
12:32:31  0:13:22  5:O2_A1   Poppıng
12:32:45  0:13:36  [ PI]  O2_A1 poor quality
12:32:51  0:13:42  [ PI]  O1_A2 poor quality
12:32:59  0:13:50  [ PI]  EOG_R poor quality
12:33:03  0:13:54  [ PI]  O1_A2 poor quality
12:33:11  0:14:01  EKG   Noise
12:33:29  0:14:16  10:EMGlsm   Noise
12:33:31  0:14:17  11:EMGrsm   Noise
12:33:39  0:14:25  [ PI]  O2_A1 poor quality
12:33:58  0:14:43  10:EMGlsm   Noise
12:34:04  0:14:44  11:EMGrsm   Noise
12:34:37  0:15:18  [ PI]  O1_A2 poor quality
12:34:39  0:15:20  [ PI]  O2_A1 poor quality
12:34:41  0:15:22  [ PI]  C3_A2 poor qualıty
12:34:42  0:15:23  [ PI]  C4_A1 poor quality
```

sub03121.txt

```
12:03:44  0:00:12  4:O1_A2   Popping
12:03:49  0:00:14  2:C3_A2   Popping
12:03:54  0:00:16  3:C4_A1   Popping
12:03:58  0:00:18  5:O2_A1   Popping
12:04:00  0:00:19  [ PI]  O1_A2 poor quality
12:04:00  0:00:19  [ PI]  C4_A1 poor quality
12:04:00  0:00:19  [ PI]  O2_A1 poor quality
12:04:06  0:00:22  4:O1_A2   Popping
12:04:11  0:00:26  3:C4_A1   Popping
12:04:16  0:00:27  5:O2_A1   Poppıng
12:04:24  0:00:32  4:O1_A2   Noise
12:04:28  0:00:34  2:C3_A2   Noise
12:04:29  0:00:34  [ PI]  O2_A1 poor quality
12:04:29  0:00:35  [ PI]  EKG poor qualıty
12:04:32  0:00:36  5:O2_A1   Popping
12:04:37  0:00:39  4:O1_A2   Popping
12:04:43  0:00:41  EKG   Noise
12:04:52  0:00:48  4:O1_A2   Flat
12:05:15  0:01:09  EKG   Noise
12:05:18  0:01:12  [ PI]  O1_A2 poor qualıty
12:05:19  0:01:13  [ PI]  EKG poor quality
12:05:25  0:01:16  EKG   Noıse
12:05:28  0:01:17  4:O1_A2   Popping
12:05:29  0:01:17  [ PI]  O2_A1 poor quality
12:05:33  0:01:19  5:O2_A1   Popping
12:05:40  0:01:22  2:C3_A2   Poppıng Noise
12:05:54  0:01:36  [ PI]  O2_A1 poor quality
12:05:55  0:01:37  [ PI]  O1_A2 poor quality
12:06:00  0:01:39  4:O1_A2   Popping
12:06:05  0:01:42  5:O2_A1   Flat
12:06:11  0:01:46  4:O1_A2   Noıse
12:06:14  0:01:48  2:C3_A2   Noise
12:06:21  0:01:54  [ PI]  O1_A2 poor quality
12:06:24  0:01:56  4:O1_A2   Flat
12:06:26  0:01:58  [ PI]  O2_A1 poor quality
```

12:06:30	0:02:00	2:C3_A2 Popping
12:06:33	0:02:02	5:O2_A1 Popping
12:06:37	0:02:04	3:C4_A1 Popping
12:06:41	0:02:08	[PI] O1_A2 poor quality
12:06:52	0:02:15	4:O1_A2 Flat
12:06:55	0:02:16	5:O2_A1 Popping
12:07:11	0:02:31	5:O2_A1 Popping
12:07:15	0:02:34	[PI] EKG poor quality
12:07:15	0:02:34	[PI] O2_A1 poor quality
12:07:19	0:02:36	EKG Noise
12:07:26	0:02:38	5:O2_A1 Popping
12:07:30	0:02:39	4:O1_A2 Popping
12:07:34	0:02:42	2:C3_A2 Popping
12:07:52	0:03:00	[PI] O2_A1 poor quality
12:07:56	0:03:03	5:O2_A1 Popping
12:08:00	0:03:05	4:O1_A2 Popping
12:08:20	0:03:23	EKG Noise
12:08:24	0:03:25	5:O2_A1 Popping
12:08:24	0:03:25	[PI] EKG poor quality
12:08:29	0:03:30	[PI] O2_A1 poor quality
12:08:31	0:03:32	[PI] C4_A1 poor quality
12:08:35	0:03:34	3:C4_A1 Popping
12:08:39	0:03:37	2:C3_A2 Popping
12:08:45	0:03:40	4:O1_A2 Flat
12:08:45	0:03:40	[PI] C3_A2 poor quality
12:08:55	0:03:50	[PI] O2_A1 poor quality
12:09:01	0:03:54	4:O1_A2 Popping
12:09:06	0:03:57	2:C3_A2 Popping
12:09:09	0:03:58	5:O2_A1 Popping
12:09:17	0:04:06	[PI] O2_A1 poor quality
12:09:21	0:04:09	5:O2_A1 Popping
12:09:25	0:04:10	3:C4_A1 Popping
12:09:29	0:04:13	4:O1_A2 Flat
12:09:45	0:04:26	4:O1_A2 Noise
12:09:53	0:04:32	2:C3_A2 Noise
12:09:53	0:04:33	[PI] O1_A2 poor quality
12:09:54	0:04:34	[PI] O2_A1 poor quality
12:10:02	0:04:37	5:O2_A1 Flat
12:10:05	0:04:38	4:O1_A2 Flat
12:10:18	0:04:50	EKG Noise
12:10:23	0:04:54	[PI] O2_A1 poor quality
12:10:25	0:04:55	4:O1_A2 Flat
12:10:31	0:04:57	5:O2_A1 Flat
12:10:40	0:05:05	[PI] EKG poor quality
12:10:43	0:05:06	4:O1_A2 Noise
12:10:47	0:05:07	EKG Noise
12:10:50	0:05:09	2:C3_A2 Noise
12:10:55	0:05:14	[PI] O2_A1 poor quality
12:10:58	0:05:15	4:O1_A2 Popping
12:11:00	0:05:17	2:C3_A2 Popping
12:11:04	0:05:18	3:C4_A1 Popping
12:11:07	0:05:19	5:O2_A1 Popping
12:11:13	0:05:24	[PI] C4_A1 poor quality
12:11:13	0:05:25	[PI] C3_A2 poor quality
12:11:42	0:05:52	4:O1_A2 Flat
12:12:01	0:06:09	2:C3_A2 Noise
12:12:05	0:06:11	4:O1_A2 Noise
12:12:35	0:06:38	4:O1_A2 Noise
12:12:43	0:06:43	EKG Noise
12:12:43	0:06:43	[PI] O1_A2 poor quality
12:12:47	0:06:45	2:C3_A2 Noise
12:12:59	0:06:58	[PI] C3_A2 poor quality
12:13:04	0:07:01	2:C3_A2 Popping
12:13:05	0:07:02	[PI] EOG_L poor quality
12:13:08	0:07:03	3:C4_A1 Popping
12:13:14	0:07:06	6:EOG_L Flat
12:13:18	0:07:09	7:EOG_R Popping
12:13:24	0:07:14	[PI] O1_A2 poor quality
12:13:29	0:07:18	4:O1_A2 Popping
12:13:33	0:07:20	2:C3_A2 Noise
12:13:42	0:07:27	4:O1_A2 Noise

```
12:13:45  0:07:28  2:C3_A2   Noise
12:13:48  0:07:29  EKG   Noise
12:13:48  0:07:29  [ PI]  O1_A2 poor quality
12:13:48  0:07:30  [ PI]  O2_A1 poor quality
12:13:57  0:07:37  4:O1_A2   Popping
12:14:00  0:07:38  2:C3_A2   Popping
12:14:04  0:07:39  3:C4_A1   Popping
12:14:07  0:07:42  5:O2_A1   Popping
12:14:23  0:07:58  [ PI]  O1_A2 poor quality
12:14:30  0:08:03  4:O1_A2   Popping
12:14:30  0:08:03  [ PI]  EOG_L poor quality
12:14:35  0:08:08  [ PI]  EOG_R poor quality
12:15:08  0:08:10  6:EOG_L   Other: I can't tell if something is wrong
12:15:19  0:08:12  7:EOG_R   Other: I can't tell if something is wrong
12:15:32  0:08:13  4:O1_A2   Other: I don't see what is wrong
12:15:32  0:08:13  [ PI]  O1_A2 poor quality
12:15:36  0:08:18  [ PI]  EOG_R poor quality
12:15:39  0:08:19  4:O1_A2   Flat
12:15:47  0:08:27  [ PI]  EOG_L poor quality
12:15:48  0:08:28  [ PI]  EOG_R poor quality
12:15:58  0:08:33  6:EOG_L   Flat
12:16:02  0:08:34  7:EOG_R   Flat
12:16:06  0:08:39  [ PI]  O2_A1 poor quality
12:16:10  0:08:41  5:O2_A1   Flat
12:16:21  0:08:49  5:O2_A1   Flat
12:16:29  0:08:58  [ PI]  O2_A1 poor quality
12:16:38  0:09:03  5:O2_A1   Flat
12:16:44  0:09:07  4:O1_A2   Noise
12:16:44  0:09:07  [ PI]  EOG_R poor quality
12:16:49  0:09:09  2:C3_A2   Noise
12:16:52  0:09:11  7:EOG_R   Popping
12:16:54  0:09:12  [ PI]  EOG_L poor quality
12:17:01  0:09:16  6:EOG_L   Flat
12:17:08  0:09:21  10:EMGlsm   Noise
12:17:17  0:09:28  4:O1_A2   Noise
12:17:20  0:09:29  2:C3_A2   Noise
12:17:43  0:09:52  [ PI]  O1_A2 poor quality
12:17:43  0:09:52  [ PI]  O2_A1 poor quality
12:17:48  0:09:54  4:O1_A2   Popping
12:17:50  0:09:56  5:O2_A1   Flat
12:18:04  0:10:05  4:O1_A2   Noise
12:18:07  0:10:07  2:C3_A2   Noise
12:18:16  0:10:16  [ PI]  O2_A1 poor quality
12:18:20  0:10:17  4:O1_A2   Popping
12:18:20  0:10:18  [ PI]  O1_A2 poor quality
12:18:23  0:10:19  2:C3_A2   Popping
12:18:26  0:10:20  5:O2_A1   Popping
12:18:37  0:10:27  4:O1_A2   Noise
12:18:40  0:10:29  2:C3_A2   Noise
12:18:45  0:10:31  5:O2_A1   Flat
12:18:54  0:10:39  [ PI]  O1_A2 poor quality
12:18:55  0:10:40  [ PI]  O2_A1 poor quality
12:18:59  0:10:44  [ PI]  EOG_L poor quality
12:18:59  0:10:44  [ PI]  EOG_R poor quality
12:19:04  0:10:46  4:O1_A2   Popping Flat
12:19:08  0:10:48  5:O2_A1   Flat
12:19:13  0:10:49  6:EOG_L   Flat
12:19:16  0:10:51  7:EOG_R   Flat
12:19:22  0:10:55  2:C3_A2   Popping
12:19:25  0:10:56  3:C4_A1   Popping
12:19:28  0:10:57  5:O2_A1   Popping
12:19:36  0:11:02  4:O1_A2   Flat
12:19:51  0:11:16  5:O2_A1   Flat
12:20:07  0:11:32  [ PI]  O1_A2 poor quality
12:20:11  0:11:34  4:O1_A2   Flat
12:20:15  0:11:37  5:O2_A1   Flat
12:20:33  0:11:52  4:O1_A2   Noise
12:20:35  0:11:54  2:C3_A2   Noise
12:20:46  0:12:04  [ PI]  O1_A2 poor quality
12:20:46  0:12:04  [ PI]  O2_A1 poor quality
12:20:49  0:12:06  4:O1_A2   Flat
```

```
12:20:53  0:12:08  5:O2_A1   Flat
12:20:54  0:12:09  [ PI]  EOG_L poor quality
12:21:06  0:12:13  6:EOG_L   Other: I don't see what is wrong
12:21:06  0:12:13  [ PI]  EOG_R poor quality
12:21:20  0:12:16  7:EOG_R   Other: I don't see what is wrong
12:21:29  0:12:23  4:O1_A2   Noise
12:21:34  0:12:26  5:O2_A1   Popping
12:21:50  0:12:42  [ PI]  O2_A1 poor quality
12:21:53  0:12:43  2:C3_A2   Noise
12:21:56  0:12:45  5:O2_A1   Flat
12:22:26  0:13:15  [ PI]  O1_A2 poor quality
12:22:26  0:13:15  [ PI]  O2_A1 poor quality
12:22:32  0:13:19  4:O1_A2   Flat
12:22:33  0:13:19  [ PI]  C4_A1 poor quality
12:22:37  0:13:20  5:O2_A1   Flat
12:22:37  0:13:20  [ PI]  EOG_R poor quality
12:22:41  0:13:21  3:C4_A1   Popping
12:22:44  0:13:23  7:EOG_R   Flat
12:23:03  0:13:31  5:O2_A1   Other: I dont' see what is wrong
12:23:08  0:13:36  [ PI]  O2_A1 poor quality
12:23:12  0:13:39  5:O2_A1   Flat
12:23:15  0:13:42  [ PI]  O1_A2 poor quality
12:23:20  0:13:43  4:O1_A2   Flat
12:23:23  0:13:45  5:O2_A1   Popping
12:23:28  0:13:50  [ PI]  EOG_R poor quality
12:23:53  0:13:53  7:EOG_R   Flat Other: The number 7:EOG R interferes with seeing the
signal
12:23:54  0:13:54  [ PI]  O1_A2 poor quality
12:24:00  0:13:57  4:O1_A2   Popping
12:24:03  0:13:59  5:O2_A1   Popping
12:24:11  0:14:06  4:O1_A2   Flat
12:24:17  0:14:10  5:O2_A1   Popping
12:24:20  0:14:11  3:C4_A1   Popping
12:24:34  0:14:22  4:O1_A2   Popping
12:24:37  0:14:25  [ PI]  O2_A1 poor quality
12:24:51  0:14:38  2:C3_A2   Popping
12:24:55  0:14:39  3:C4_A1   Popping
12:24:58  0:14:41  5:O2_A1   Popping
12:25:01  0:14:42  4:O1_A2   Flat
12:25:06  0:14:45  4:O1_A2   Popping
12:25:10  0:14:46  5:O2_A1   Popping
12:25:42  0:15:18  [ PI]  O1_A2 poor quality
12:25:44  0:15:20  [ PI]  O2_A1 poor quality
12:25:48  0:15:21  5:O2_A1   Popping
12:25:52  0:15:22  2:C3_A2   Popping
12:25:52  0:15:22  [ PI]  C3_A2 poor quality
12:25:55  0:15:23  4:O1_A2   Popping
12:25:55  0:15:23  [ PI]  C4_A1 poor quality
12:25:59  0:15:26  3:C4_A1   Popping
```

sub04110.txt

```
12:15:36  0:00:18  4:O1_A2   Flat
12:15:36  0:00:19  [ PI]  O1_A2 poor quality
12:15:36  0:00:19  [ PI]  C4_A1 poor quality
12:15:36  0:00:19  [ PI]  O2_A1 poor quality
12:15:51  0:00:27  4:O1_A2   Popping
12:15:59  0:00:29  11:EMGrsm   Noise
12:16:05  0:00:33  4:O1_A2   Noise
12:16:06  0:00:34  [ PI]  O2_A1 poor quality
12:16:11  0:00:35  2:C3_A2   Noise
12:16:11  0:00:35  [ PI]  EKG poor quality
12:16:18  0:00:37  3:C4_A1   Popping
12:16:23  0:00:38  5:O2_A1   Popping
12:16:39  0:00:48  3:C4_A1   Noise
12:16:52  0:00:50  4:O1_A2   Flat
12:17:03  0:00:54  4:O1_A2   Flat
12:17:09  0:00:57  EKG   Noise
12:17:19  0:00:59  4:O1_A2   Flat
12:17:35  0:01:11  2:C3_A2   Noise
```

12:17:36 0:01:12 [PI] O1_A2 poor quality
12:17:37 0:01:13 [PI] EKG poor quality
12:17:43 0:01:15 4:O1_A2 Popping
12:17:51 0:01:16 2:C3_A2 Popping
12:17:57 0:01:17 3:C4_A1 Popping
12:17:57 0:01:17 [PI] O2_A1 poor quality
12:18:00 0:01:18 5:O2_A1 Popping
12:18:13 0:01:24 4:O1_A2 Flat
12:18:28 0:01:27 5:O2_A1 Flat
12:18:44 0:01:30 4:O1_A2 Popping
12:18:51 0:01:36 [PI] O2_A1 poor quality
12:18:52 0:01:37 [PI] O1_A2 poor quality
12:19:07 0:01:40 4:O1_A2 Popping
12:19:09 0:01:41 5:O2_A1 Flat
12:19:29 0:01:48 4:O1_A2 Flat
12:19:35 0:01:49 4:O1_A2 Noise
12:19:40 0:01:54 [PI] O1_A2 poor quality
12:19:46 0:01:57 EKG Noise
12:19:47 0:01:58 [PI] O2_A1 poor quality
12:19:58 0:01:59 4:O1_A2 Popping
12:20:07 0:02:08 [PI] O1_A2 poor quality
12:20:14 0:02:09 4:O1_A2 Popping
12:20:34 0:02:13 4:O1_A2 Popping
12:20:41 0:02:15 5:O2_A1 Noise
12:20:45 0:02:17 10:EMGlsm Noise
12:20:50 0:02:19 11:EMGrsm Noise
12:21:00 0:02:23 4:O1_A2 Flat
12:21:09 0:02:28 4:O1_A2 Flat
12:21:19 0:02:32 3:C4_A1 Noise
12:21:21 0:02:34 [PI] EKG poor quality
12:21:21 0:02:34 [PI] O2_A1 poor quality
12:21:29 0:02:36 4:O1_A2 Popping
12:21:33 0:02:37 5:O2_A1 Popping
12:21:37 0:02:40 2:C3_A2 Popping
12:21:51 0:02:44 4:O1_A2 Flat
12:22:04 0:02:48 4:O1_A2 Flat
12:22:19 0:02:54 4:O1_A2 Flat
12:22:26 0:02:58 4:O1_A2 Popping
12:22:29 0:03:00 [PI] O2_A1 poor quality
12:22:33 0:03:01 2:C3_A2 Noise
12:22:41 0:03:04 3:C4_A1 Noise
12:22:50 0:03:11 10:EMGlsm Noise
12:22:56 0:03:14 4:O1_A2 Popping
12:23:08 0:03:21 10:EMGlsm Noise
12:23:33 0:03:24 EKG Other: disturbance/arythmic
12:23:34 0:03:25 [PI] EKG poor quality
12:23:47 0:03:28 2:C3_A2 Noise
12:23:49 0:03:30 4:O1_A2 Popping
12:23:50 0:03:30 [PI] O2_A1 poor quality
12:23:52 0:03:32 [PI] C4_A1 poor quality
12:23:58 0:03:33 2:C3_A2 Popping
12:24:05 0:03:40 [PI] C3_A2 poor quality
12:24:11 0:03:43 4:O1_A2 Flat
12:24:20 0:03:46 3:C4_A1 Popping
12:24:24 0:03:50 [PI] O2_A1 poor quality
12:24:37 0:03:54 4:O1_A2 Popping
12:24:47 0:03:56 4:O1_A2 Flat
12:24:58 0:04:03 4:O1_A2 Flat
12:25:01 0:04:06 [PI] O2_A1 poor quality
12:25:13 0:04:13 4:O1_A2 Flat
12:25:31 0:04:24 4:O1_A2 Noise
12:25:41 0:04:33 [PI] O1_A2 poor quality
12:25:42 0:04:34 [PI] O2_A1 poor quality
12:25:55 0:04:35 3:C4_A1 Flat
12:26:01 0:04:37 4:O1_A2 Popping
12:26:05 0:04:39 4:O1_A2 Flat
12:26:12 0:04:43 4:O1_A2 Flat
12:26:26 0:04:49 EKG Noise
12:26:31 0:04:51 10:EMGlsm Noise
12:26:34 0:04:54 [PI] O2_A1 poor quality
12:26:38 0:04:55 4:O1_A2 Popping

```
12:26:46  0:04:59  2:C3_A2   Flat
12:26:52  0:05:05  [ PI]  EKG poor quality
12:27:12  0:05:07  EKG   Noise Other: arythmic
12:27:21  0:05:14  4:O1_A2   Flat
12:27:22  0:05:14  [ PI]  O2_A1 poor quality
12:27:26  0:05:16  2:C3_A2   Popping
12:27:38  0:05:24  4:O1_A2   Popping
12:27:38  0:05:24  [ PI]  C4_A1 poor quality
12:27:39  0:05:25  [ PI]  C3_A2 poor quality
12:27:53  0:05:37  4:O1_A2   Flat
12:27:57  0:05:39  3:C4_A1   Popping
12:28:08  0:05:47  4:O1_A2   Flat
12:28:13  0:05:49  EKG   Noise
12:28:25  0:05:56  4:O1_A2   Flat
12:28:42  0:06:09  EKG   Noise
12:28:48  0:06:13  4:O1_A2   Flat
12:28:54  0:06:17  10:EMGlsm   Noise
12:29:13  0:06:34  4:O1_A2   Flat
12:29:24  0:06:40  EKG   Noise
12:29:27  0:06:43  [ PI]  O1_A2 poor quality
12:29:34  0:06:47  4:O1_A2   Flat
12:29:49  0:06:57  4:O1_A2   Noise
12:29:51  0:06:58  [ PI]  C3_A2 poor quality
12:30:02  0:07:02  2:C3_A2   Popping
12:30:02  0:07:02  [ PI]  EOG_L poor quality
12:30:12  0:07:08  7:EOG_R   Popping
12:30:18  0:07:14  [ PI]  O1_A2 poor quality
12:30:38  0:07:16  EKG   Noise Other: peaked heartbeat
12:30:52  0:07:24  4:O1_A2   Noise
12:31:01  0:07:27  4:O1_A2   Noise
12:31:04  0:07:29  [ PI]  O1_A2 poor quality
12:31:05  0:07:30  [ PI]  O2_A1 poor quality
12:31:09  0:07:31  EKG   Noise
12:31:14  0:07:33  4:O1_A2   Popping
12:31:20  0:07:38  2:C3_A2   Popping
12:31:28  0:07:40  3:C4_A1   Flat
12:31:33  0:07:42  5:O2_A1   Flat
12:31:39  0:07:46  10:EMGlsm   Noise
12:31:45  0:07:50  4:O1_A2   Popping
12:31:52  0:07:58  [ PI]  O1_A2 poor quality
12:31:57  0:08:03  [ PI]  EOG_L poor quality
12:32:00  0:08:04  4:O1_A2   Flat
12:32:04  0:08:08  [ PI]  EOG_R poor quality
12:32:09  0:08:13  [ PI]  O1_A2 poor quality
12:32:14  0:08:16  4:O1_A2   Flat
12:32:16  0:08:18  [ PI]  EOG_R poor quality
12:32:21  0:08:21  10:EMGlsm   Noise
12:32:26  0:08:25  11:EMGrsm   Noise
12:32:30  0:08:27  4:O1_A2   Flat
12:32:30  0:08:27  [ PI]  EOG_L poor quality
12:32:31  0:08:28  [ PI]  EOG_R poor quality
12:32:41  0:08:35  4:O1_A2   Noise
12:32:45  0:08:36  2:C3_A2   Noise
12:32:48  0:08:39  [ PI]  O2_A1 poor quality
12:32:55  0:08:44  5:O2_A1   Flat
12:33:09  0:08:58  [ PI]  O2_A1 poor quality
12:33:20  0:09:04  7:EOG_R   Popping
12:33:23  0:09:07  [ PI]  EOG_R poor quality
12:33:28  0:09:12  [ PI]  EOG_L poor quality
12:33:45  0:09:25  4:O1_A2   Noise
12:34:11  0:09:52  [ PI]  O1_A2 poor quality
12:34:11  0:09:52  [ PI]  O2_A1 poor quality
12:34:15  0:09:54  4:O1_A2   Popping
12:34:18  0:09:55  5:O2_A1   Flat
12:34:39  0:10:16  [ PI]  O2_A1 poor quality
12:34:46  0:10:18  4:O1_A2   Popping
12:34:47  0:10:18  [ PI]  O1_A2 poor quality
12:35:04  0:10:31  5:O2_A1   Flat
12:35:12  0:10:39  [ PI]  O1_A2 poor quality
12:35:13  0:10:40  [ PI]  O2_A1 poor quality
12:35:18  0:10:43  4:O1_A2   Popping
```

```
12:35:19  0:10:44  [ PI]  EOG_L poor quality
12:35:19  0:10:44  [ PI]  EOG_R poor quality
12:35:27  0:10:50  5:O2_A1   Flat
12:35:41  0:11:02  4:O1_A2   Flat
12:36:12  0:11:32  [ PI]  O1_A2 poor quality
12:36:20  0:11:34  4:O1_A2   Flat
12:36:26  0:11:39  4:O1_A2   Popping
12:36:52  0:12:04  [ PI]  O1_A2 poor quality
12:36:52  0:12:04  [ PI]  O2_A1 poor quality
12:36:56  0:12:07  4:O1_A2   Flat
12:36:58  0:12:09  [ PI]  EOG_L poor quality
12:37:02  0:12:13  [ PI]  EOG_R poor quality
12:37:31  0:12:42  [ PI]  O2_A1 poor quality
12:37:35  0:12:45  5:O2_A1   Flat
12:38:06  0:13:15  [ PI]  O1_A2 poor quality
12:38:06  0:13:15  [ PI]  O2_A1 poor quality
12:38:10  0:13:18  4:O1_A2   Flat
12:38:12  0:13:19  [ PI]  C4_A1 poor quality
12:38:13  0:13:20  [ PI]  EOG_R poor quality
12:38:29  0:13:36  [ PI]  O2_A1 poor quality
12:38:34  0:13:40  5:O2_A1   Flat
12:38:36  0:13:42  [ PI]  O1_A2 poor quality
12:38:40  0:13:45  4:O1_A2   Popping
12:38:45  0:13:50  [ PI]  EOG_R poor quality
12:38:49  0:13:54  [ PI]  O1_A2 poor quality
12:39:01  0:14:05  4:O1_A2   Popping
12:39:21  0:14:25  [ PI]  O2_A1 poor quality
12:39:31  0:14:34  3:C4_A1   Popping
12:39:45  0:14:47  3:C4_A1   Popping
12:40:00  0:15:00  EKG   Noise
12:40:18  0:15:18  [ PI]  O1_A2 poor quality
12:40:20  0:15:20  [ PI]  O2_A1 poor quality
12:40:22  0:15:22  [ PI]  C3_A2 poor quality
12:40:23  0:15:23  [ PI]  C4_A1 poor quality
12:40:26  0:15:26  4:O1_A2   Popping
```

sub04121.txt

```
12:04:35  0:00:19  [ PI]  O1_A2 poor quality
12:04:35  0:00:19  [ PI]  C4_A1 poor quality
12:04:35  0:00:19  [ PI]  O2_A1 poor quality
12:04:49  0:00:22  4:O1_A2   Popping
12:04:54  0:00:24  3:C4_A1   Flat
12:05:01  0:00:26  5:O2_A1   Flat
12:05:10  0:00:34  [ PI]  O2_A1 poor quality
12:05:20  0:00:35  5:O2_A1   Popping
12:05:21  0:00:35  [ PI]  EKG poor quality
12:05:27  0:00:39  EKG   Noise
12:05:39  0:00:48  4:O1_A2   Flat
12:06:02  0:01:12  [ PI]  O1_A2 poor quality
12:06:03  0:01:13  [ PI]  EKG poor quality
12:06:09  0:01:15  EKG   Noise
12:06:12  0:01:17  5:O2_A1   Popping
12:06:12  0:01:17  [ PI]  O2_A1 poor quality
12:06:23  0:01:26  5:O2_A1   Flat
12:06:27  0:01:29  4:O1_A2   Popping
12:06:35  0:01:36  [ PI]  O2_A1 poor quality
12:06:36  0:01:37  [ PI]  O1_A2 poor quality
12:06:39  0:01:38  5:O2_A1   Flat
12:06:55  0:01:54  [ PI]  O1_A2 poor quality
12:07:05  0:01:55  4:O1_A2   Other: saturation
12:07:10  0:01:58  5:O2_A1   Popping
12:07:10  0:01:58  [ PI]  O2_A1 poor quality
12:07:20  0:02:08  [ PI]  O1_A2 poor quality
12:07:33  0:02:17  5:O2_A1   Popping
12:07:46  0:02:28  4:O1_A2   Flat
12:07:54  0:02:34  5:O2_A1   Popping
12:07:55  0:02:34  [ PI]  EKG poor quality
12:07:55  0:02:34  [ PI]  O2_A1 poor quality
12:08:02  0:02:37  EKG   Noise
```

12:08:05 0:02:39 2:C3_A2   Popping
12:08:09 0:02:41 3:C4_A1   Popping
12:08:17 0:02:48 5:O2_A1   Popping
12:08:30 0:02:59 EKG   Noise
12:08:31 0:03:00 [PI] O2_A1 poor quality
12:08:36 0:03:03 5:O2_A1   Popping
12:08:52 0:03:15 4:O1_A2   Popping
12:09:02 0:03:23 EKG   Noise
12:09:04 0:03:25 [PI] EKG poor quality
12:09:07 0:03:26 5:O2_A1   Popping
12:09:10 0:03:28 EKG   Noise
12:09:13 0:03:30 [PI] O2_A1 poor quality
12:09:16 0:03:32 5:O2_A1   Popping
12:09:17 0:03:32 [PI] C4_A1 poor quality
12:09:23 0:03:34 2:C3_A2   Popping
12:09:28 0:03:37 3:C4_A1   Popping
12:09:31 0:03:40 [PI] C3_A2 poor quality
12:09:38 0:03:44 4:O1_A2   Flat
12:09:43 0:03:50 [PI] O2_A1 poor quality
12:09:48 0:03:53 5:O2_A1   Popping
12:09:51 0:03:54 EKG   Noise
12:09:55 0:03:56 5:O2_A1   Popping
12:10:04 0:04:06 [PI] O2_A1 poor quality
12:10:07 0:04:07 4:O1_A2   Popping
12:10:13 0:04:11 5:O2_A1   Popping
12:10:19 0:04:16 4:O1_A2   Flat
12:10:40 0:04:27 4:O1_A2   Noise
12:10:46 0:04:33 [PI] O1_A2 poor quality
12:10:47 0:04:34 [PI] O2_A1 poor quality
12:10:56 0:04:35 4:O1_A2   Other: saturation
12:11:07 0:04:38 5:O2_A1   Other: saturation
12:11:19 0:04:49 EKG   Noise
12:11:25 0:04:54 [PI] O2_A1 poor quality
12:11:36 0:04:56 5:O2_A1   Other: saturation
12:11:45 0:05:05 [PI] EKG poor quality
12:11:51 0:05:08 EKG   Noise
12:11:56 0:05:14 [PI] O2_A1 poor quality
12:11:59 0:05:15 3:C4_A1   Popping
12:12:02 0:05:16 5:O2_A1   Popping
12:12:07 0:05:19 4:O1_A2   Flat
12:12:12 0:05:24 EKG   Noise
12:12:13 0:05:24 [PI] C4_A1 poor quality
12:12:14 0:05:25 [PI] C3_A2 poor quality
12:12:16 0:05:26 3:C4_A1   Popping
12:12:18 0:05:27 5:O2_A1   Popping
12:12:37 0:05:44 4:O1_A2   Flat
12:13:17 0:06:14 EKG   Other: fluctuation
12:13:46 0:06:41 EKG   Noise
12:13:48 0:06:43 [PI] O1_A2 poor quality
12:13:58 0:06:46 4:O1_A2   Other: saturation
12:14:10 0:06:58 [PI] C3_A2 poor quality
12:14:14 0:07:01 2:C3_A2   Popping
12:14:16 0:07:02 [PI] EOG_L poor quality
12:14:21 0:07:04 3:C4_A1   Popping
12:14:24 0:07:05 6:EOG_L   Popping
12:14:33 0:07:14 [PI] O1_A2 poor quality
12:14:51 0:07:29 EKG   Noise
12:14:51 0:07:29 [PI] O1_A2 poor quality
12:14:52 0:07:30 [PI] O2_A1 poor quality
12:14:56 0:07:32 5:O2_A1   Popping
12:15:03 0:07:35 4:O1_A2   Other: saturation
12:15:09 0:07:40 2:C3_A2   Popping
12:15:19 0:07:48 5:O2_A1   Flat
12:15:29 0:07:58 [PI] O1_A2 poor quality
12:15:36 0:08:00 4:O1_A2   Other: saturation
12:15:39 0:08:03 [PI] EOG_L poor quality
12:15:45 0:08:06 6:EOG_L   Flat
12:15:47 0:08:08 [PI] EOG_R poor quality
12:15:53 0:08:11 7:EOG_R   Flat
12:15:55 0:08:13 [PI] O1_A2 poor quality
12:16:00 0:08:18 [PI] EOG_R poor quality

12:16:05 0:08:22 5:O2_A1   Noise
12:16:10 0:08:27 [PI] EOG_L poor quality
12:16:11 0:08:28 [PI] EOG_R poor quality
12:16:16 0:08:29 6:EOG_L   Flat
12:16:26 0:08:39 [PI] O2_A1 poor quality
12:16:32 0:08:40 5:O2_A1   Other: saturation
12:16:46 0:08:51 5:O2_A1   Flat
12:16:53 0:08:58 [PI] O2_A1 poor quality
12:16:58 0:09:00 5:O2_A1   Flat
12:17:05 0:09:07 [PI] EOG_R poor quality
12:17:09 0:09:09 7:EOG_R   Flat
12:17:12 0:09:12 [PI] EOG_L poor quality
12:17:19 0:09:17 6:EOG_L   Flat
12:17:58 0:09:52 4:O1_A2   Flat
12:17:58 0:09:52 [PI] O1_A2 poor quality
12:17:58 0:09:52 [PI] O2_A1 poor quality
12:18:01 0:09:55 5:O2_A1   Flat
12:18:22 0:10:16 [PI] O2_A1 poor quality
12:18:26 0:10:17 5:O2_A1   Popping
12:18:27 0:10:18 [PI] O1_A2 poor quality
12:18:32 0:10:20 4:O1_A2   Flat
12:18:47 0:10:34 4:O1_A2   Noise
12:18:52 0:10:39 [PI] O1_A2 poor qualıty
12:18:53 0:10:40 [PI] O2_A1 poor quality
12:18:57 0:10:42 5:O2_A1   Flat
12:18:59 0:10:44 [PI] EOG_L poor quality
12:18:59 0:10:44 [PI] EOG_R poor quality
12:19:03 0:10:46 5:O2_A1   Flat
12:19:07 0:10:48 6:EOG_L   Flat
12:19:12 0:10:49 7:EOG_R   Flat
12:19:21 0:10:56 4:O1_A2   Noise
12:19:30 0:11:04 4:O1_A2   Flat
12:19:40 0:11:13 4:O1_A2   Noise
12:20:00 0:11:32 [PI] O1_A2 poor quality
12:20:03 0:11:33 4:O1_A2   Flat
12:20:07 0:11:37 5:O2_A1
12:20:35 0:12:04 [PI] O1_A2 poor quality
12:20:35 0:12:04 [PI] O2_A1 poor qualıty
12:20:47 0:12:06 4:O1_A2   Flat Other: sAaturatıon
12:20:51 0:12:08 5:O2_A1   Popping
12:20:52 0:12:09 [PI] EOG_L poor quality
12:20:56 0:12:11 6:EOG_L   Flat
12:20:58 0:12:13 [PI] EOG_R poor quality
12:21:02 0:12:16 6:EOG_L
12:21:07 0:12:17 7:EOG_R   Flat
12:21:13 0:12:22 4:O1_A2   Noise
12:21:33 0:12:42 [PI] O2_A1 poor qualıty
12:21:36 0:12:43 5:O2_A1   Flat
12:22:08 0:13:15 [PI] O1_A2 poor quality
12:22:08 0:13:15 [PI] O2_A1 poor quality
12:22:14 0:13:18 4:O1_A2   Flat
12:22:16 0:13:19 5:O2_A1   Flat
12:22:17 0:13:19 [PI] C4_A1 poor quality
12:22:17 0:13:20 [PI] EOG_R poor quality
12:22:24 0:13:24 7:EOG_R   Flat
12:22:37 0:13:36 [PI] O2_A1 poor quality
12:22:40 0:13:38 5:O2_A1   Flat
12:22:44 0:13:42 [PI] O1_A2 poor quality
12:22:55 0:13:44 4:O1_A2   Other: saturation
12:23:01 0:13:50 [PI] EOG_R poor quality
12:23:05 0:13:54 [PI] O1_A2 poor quality
12:23:10 0:13:55 7:EOG_R   Noise
12:23:26 0:14:05 4:O1_A2   Noise Other: saturation
12:23:46 0:14:25 [PI] O2_A1 poor quality
12:23:50 0:14:27 5:O2_A1   Flat
12:24:01 0:14:37 3:C4_A1
12:24:07 0:14:42 4:O1_A2   Poppıng
12:24:11 0:14:44 5:O2_A1   Popping
12:24:23 0:14:55 4:O1_A2   Noıse
12:24:46 0:15:18 [PI] O1_A2 poor quality
12:24:55 0:15:20 4:O1_A2   Flat

```
12:24:55  0:15:20  [ PI]  O2_A1 poor quality
12:24:57  0:15:22  [ PI]  C3_A2 poor quality
12:24:58  0:15:23  [ PI]  C4_A1 poor quality
12:25:00  0:15:24  5:O2_A1   Popping
12:25:02  0:15:25  3:C4_A1   Popping
12:25:20  0:15:26  EKG   Noise
```

sub05110.txt

```
12:15:31  0:00:17  4:O1_A2
12:15:36  0:00:18  4:O1_A2   Flat
12:15:38  0:00:19  [ PI]  O1_A2 poor quality
12:15:38  0:00:19  [ PI]  C4_A1 poor quality
12:15:38  0:00:19  [ PI]  O2_A1 poor quality
12:15:47  0:00:24  4:O1_A2   Popping
12:16:05  0:00:33  7:EOG_R
12:16:06  0:00:34  [ PI]  O2_A1 poor quality
12:16:07  0:00:35  [ PI]  EKG poor quality
12:16:18  0:00:36  6:EOG_L   Noise
12:16:44  0:00:38  5:O2_A1   Popping
12:16:48  0:00:39  5:O2_A1   Popping
12:17:01  0:00:40  4:O1_A2   Popping
12:17:22  0:00:47  4:O1_A2   Flat
12:17:47  0:01:12  [ PI]  O1_A2 poor quality
12:17:48  0:01:13  [ PI]  EKG poor quality
12:17:54  0:01:15  4:O1_A2   Popping
12:18:28  0:01:17  2:C3_A2
12:18:28  0:01:17  [ PI]  O2_A1 poor quality
12:18:38  0:01:21  5:O2_A1   Popping
12:19:05  0:01:29  4:O1_A2   Popping
12:19:12  0:01:36  [ PI]  O2_A1 poor quality
12:19:14  0:01:37  [ PI]  O1_A2 poor quality
12:19:21  0:01:40  4:O1_A2   Popping
12:19:35  0:01:54  [ PI]  O1_A2 poor quality
12:19:47  0:01:57  4:O1_A2   Popping
12:19:47  0:01:58  [ PI]  O2_A1 poor quality
12:19:50  0:01:59  5:O2_A1   Popping
12:19:59  0:02:08  [ PI]  O1_A2 poor quality
12:20:07  0:02:10  4:O1_A2
12:20:12  0:02:13  4:O1_A2   Popping
12:20:39  0:02:34  4:O1_A2   Flat
12:20:40  0:02:34  [ PI]  EKG poor quality
12:20:40  0:02:34  [ PI]  O2_A1 poor quality
12:21:19  0:02:38  5:O2_A1
12:21:41  0:03:00  [ PI]  O2_A1 poor quality
12:22:12  0:03:21  10:EMGlsm
12:22:21  0:03:24  EKG   Noise
12:22:22  0:03:25  [ PI]  EKG poor quality
12:22:27  0:03:30  [ PI]  O2_A1 poor quality
12:22:29  0:03:32  [ PI]  C4_A1 poor quality
12:22:38  0:03:34  6:EOG_L   Noise
12:23:02  0:03:36  5:O2_A1
12:23:06  0:03:40  [ PI]  C3_A2 poor quality
12:23:34  0:03:49  4:O1_A2   Other: too much saturation
12:23:35  0:03:50  [ PI]  O2_A1 poor quality
12:23:48  0:03:56  EKG   Noise
12:23:58  0:04:06  [ PI]  O2_A1 poor quality
12:24:25  0:04:33  [ PI]  O1_A2 poor quality
12:24:26  0:04:34  [ PI]  O2_A1 poor quality
12:24:46  0:04:54  [ PI]  O2_A1 poor quality
12:24:58  0:05:05  [ PI]  EKG poor quality
12:25:07  0:05:14  [ PI]  O2_A1 poor quality
12:25:17  0:05:24  [ PI]  C4_A1 poor quality
12:25:18  0:05:25  [ PI]  C3_A2 poor quality
12:26:15  0:05:58  4:O1_A2   Other: not popping or flat,  looks
12:26:38  0:06:02  4:O1_A2   Other: (cont) more like signal saturation (good electrode)
12:26:53  0:06:14  6:EOG_L   Noise
12:27:21  0:06:40  EKG   Noise
12:27:24  0:06:43  [ PI]  O1_A2 poor quality
12:27:29  0:06:45  6:EOG_L   Noise
```

```
12:27:42  0:06:58  [ PI]  C3_A2 poor quality
12:27:46  0:07:02  [ PI]  EOG_L poor quality
12:28:05  0:07:05  2:C3_A2   Popping
12:28:11  0:07:06  7:EOG_R   Popping
12:28:19  0:07:14  [ PI]  O1_A2 poor quality
12:28:38  0:07:18  6:EOG_L
12:28:48  0:07:29  [ PI]  O1_A2 poor quality
12:28:49  0:07:30  [ PI]  O2_A1 poor quality
12:29:16  0:07:42  5:O2_A1
12:29:33  0:07:51  4:O1_A2
12:29:40  0:07:58  [ PI]  O1_A2 poor quality
12:29:45  0:08:03  [ PI]  EOG_L poor quality
12:29:50  0:08:08  [ PI]  EOG_R poor quality
12:29:55  0:08:13  [ PI]  O1_A2 poor quality
12:30:00  0:08:18  [ PI]  EOG_R poor quality
12:30:09  0:08:27  [ PI]  EOG_L poor quality
12:30:10  0:08:28  [ PI]  EOG_R poor quality
12:30:25  0:08:39  6:EOG_L   Noise
12:30:25  0:08:39  [ PI]  O2_A1 poor quality
12:30:42  0:08:48  5:O2_A1   Flat
12:30:52  0:08:58  [ PI]  O2_A1 poor quality
12:31:39  0:09:04  7:EOG_R   Other: can he vibrate his eyes this fast?
12:31:42  0:09:07  [ PI]  EOG_R poor quality
12:31:47  0:09:12  [ PI]  EOG_L poor quality
12:32:27  0:09:52  [ PI]  O1_A2 poor quality
12:32:27  0:09:52  [ PI]  O2_A1 poor quality
12:32:35  0:09:56  4:O1_A2   Popping
12:32:54  0:10:16  [ PI]  O2_A1 poor quality
12:32:56  0:10:18  [ PI]  O1_A2 poor quality
12:33:18  0:10:29  4:O1_A2
12:33:21  0:10:31  6:EOG_L   Noise
12:33:29  0:10:39  [ PI]  O1_A2 poor quality
12:33:30  0:10:40  [ PI]  O2_A1 poor quality
12:33:34  0:10:44  [ PI]  EOG_L poor quality
12:33:34  0:10:44  [ PI]  EOG_R poor quality
12:33:57  0:10:48  4:O1_A2
12:34:41  0:11:32  [ PI]  O1_A2 poor quality
12:34:52  0:11:41  4:O1_A2   Popping
12:35:15  0:12:04  [ PI]  O1_A2 poor quality
12:35:15  0:12:04  [ PI]  O2_A1 poor quality
12:35:20  0:12:09  [ PI]  EOG_L poor quality
12:35:24  0:12:13  [ PI]  EOG_R poor quality
12:35:53  0:12:42  [ PI]  O2_A1 poor quality
12:36:12  0:12:46  5:O2_A1   Other: saturation
12:36:41  0:13:15  [ PI]  O1_A2 poor quality
12:36:41  0:13:15  [ PI]  O2_A1 poor quality
12:36:45  0:13:19  [ PI]  C4_A1 poor quality
12:36:46  0:13:20  [ PI]  EOG_R poor quality
12:36:49  0:13:21  4:O1_A2   Popping
12:37:03  0:13:36  [ PI]  O2_A1 poor quality
12:37:09  0:13:42  [ PI]  O1_A2 poor quality
12:37:16  0:13:47  4:O1_A2   Popping
12:37:19  0:13:50  [ PI]  EOG_R poor quality
12:37:23  0:13:54  [ PI]  O1_A2 poor quality
12:37:54  0:14:25  [ PI]  O2_A1 poor quality
12:38:47  0:15:18  [ PI]  O1_A2 poor quality
12:38:49  0:15:20  [ PI]  O2_A1 poor quality
12:38:51  0:15:22  [ PI]  C3_A2 poor quality
12:38:52  0:15:23  [ PI]  C4_A1 poor quality
12:39:19  0:15:26  EKG   Noise
12:39:55  0:15:26  6:EOG_L   Noise
```

sub05121.txt

```
12:04:31  0:00:19  [ PI]  O1_A2 poor quality
12:04:31  0:00:19  [ PI]  C4_A1 poor quality
12:04:31  0:00:19  [ PI]  O2_A1 poor quality
12:04:57  0:00:27  3:C4_A1   Popping
12:05:04  0:00:34  [ PI]  O2_A1 poor quality
12:05:05  0:00:35  [ PI]  EKG poor quality
```

```
12:05:23  0:00:41  5:O2_A1
12:05:53  0:01:12  [ PI]  O1_A2 poor quality
12:05:54  0:01:13  [ PI]  EKG poor quality
12:06:03  0:01:17  EKG   Noise
12:06:03  0:01:17  [ PI]  O2_A1 poor quality
12:06:21  0:01:36  [ PI]  O2_A1 poor quality
12:06:22  0:01:37  [ PI]  O1_A2 poor quality
12:06:39  0:01:54  [ PI]  O1_A2 poor quality
12:06:43  0:01:58  [ PI]  O2_A1 poor quality
12:06:56  0:02:06  EKG   Noise
12:06:58  0:02:08  [ PI]  O1_A2 poor quality
12:07:31  0:02:33  4:O1_A2   Other: out of range
12:07:32  0:02:34  [ PI]  EKG poor quality
12:07:32  0:02:34  [ PI]  O2_A1 poor quality
12:07:38  0:02:38  EKG   Noise
12:07:44  0:02:42  5:O2_A1   Popping
12:07:52  0:02:47  4:O1_A2   Popping
12:08:04  0:03:00  [ PI]  O2_A1 poor quality
12:08:15  0:03:08  5:O2_A1   Popping
12:08:31  0:03:11  4:O1_A2   Other: saturation
12:08:45  0:03:25  [ PI]  EKG poor quality
12:08:51  0:03:29  4:O1_A2
12:08:52  0:03:30  [ PI]  O2_A1 poor quality
12:08:54  0:03:32  [ PI]  C4_A1 poor quality
12:09:03  0:03:39  6:EOG_L   Noise
12:09:04  0:03:40  [ PI]  C3_A2 poor quality
12:09:09  0:03:41  EKG   Noise
12:09:18  0:03:50  [ PI]  O2_A1 poor quality
12:09:26  0:03:55  5:O2_A1   Popping
12:09:33  0:03:59  2:C3_A2   Flat
12:09:36  0:04:01  4:O1_A2   Popping
12:09:41  0:04:06  [ PI]  O2_A1 poor quality
12:09:53  0:04:16  6:EOG_L   Flat
12:10:10  0:04:33  [ PI]  O1_A2 poor quality
12:10:11  0:04:34  [ PI]  O2_A1 poor quality
12:10:18  0:04:38  5:O2_A1   Popping
12:10:22  0:04:40  4:O1_A2   Popping
12:10:35  0:04:54  [ PI]  O2_A1 poor quality
12:10:46  0:05:03  4:O1_A2   Popping
12:10:48  0:05:05  [ PI]  EKG poor quality
12:10:57  0:05:14  [ PI]  O2_A1 poor quality
12:11:03  0:05:15  5:O2_A1   Popping
12:11:12  0:05:22  4:O1_A2   Popping
12:11:15  0:05:24  [ PI]  C4_A1 poor quality
12:11:16  0:05:25  [ PI]  C3_A2 poor quality
12:11:22  0:05:29  5:O2_A1   Popping
12:11:26  0:05:31  2:C3_A2   Popping
12:11:39  0:05:40  4:O1_A2   Other: saturation
12:12:42  0:06:43  [ PI]  O1_A2 poor quality
12:12:46  0:06:44  EKG   Noise
12:12:53  0:06:49  2:C3_A2   Noise
12:12:58  0:06:53  4:O1_A2   Noise
12:13:03  0:06:58  [ PI]  C3_A2 poor quality
12:13:07  0:07:02  [ PI]  EOG_L poor quality
12:13:12  0:07:03  6:EOG_L   Noise
12:13:27  0:07:10  7:EOG_R   Other: looks odd
12:13:31  0:07:14  [ PI]  O1_A2 poor quality
12:13:46  0:07:29  [ PI]  O1_A2 poor quality
12:13:47  0:07:30  [ PI]  O2_A1 poor quality
12:13:59  0:07:35  4:O1_A2   Flat
12:14:05  0:07:38  5:O2_A1   Popping
12:14:22  0:07:52  4:O1_A2   Popping
12:14:25  0:07:53  5:O2_A1   Popping
12:14:30  0:07:58  [ PI]  O1_A2 poor quality
12:14:35  0:08:03  [ PI]  EOG_L poor quality
12:14:39  0:08:04  6:EOG_L   Flat
12:14:42  0:08:08  [ PI]  EOG_R poor quality
12:14:47  0:08:13  [ PI]  O1_A2 poor quality
12:14:52  0:08:18  [ PI]  EOG_R poor quality
12:15:01  0:08:27  [ PI]  EOG_L poor quality
12:15:02  0:08:28  [ PI]  EOG_R poor quality
```

```
12:15:13  0:08:39  [ PI]  O2_A1 poor quality
12:15:29  0:08:51  5:O2_A1   Other: saturation
12:15:36  0:08:58  [ PI]  O2_A1 poor quality
12:15:45  0:09:07  [ PI]  EOG_R poor quality
12:15:49  0:09:10  4:O1_A2   Noise
12:15:53  0:09:12  2:C3_A2   Noise
12:15:54  0:09:12  [ PI]  EOG_L poor quality
12:16:43  0:09:32  6:EOG_L   Other: doesn't complement right signal
12:17:03  0:09:52  [ PI]  O1_A2 poor quality
12:17:03  0:09:52  [ PI]  O2_A1 poor quality
12:17:24  0:09:59  4:O1_A2   Popping Other: range problems
12:17:40  0:10:16  [ PI]  O2_A1 poor quality
12:17:42  0:10:18  [ PI]  O1_A2 poor quality
12:17:50  0:10:24  4:O1_A2   Noise
12:18:05  0:10:39  [ PI]  O1_A2 poor quality
12:18:06  0:10:40  [ PI]  O2_A1 poor quality
12:18:10  0:10:44  [ PI]  EOG_L poor quality
12:18:10  0:10:44  [ PI]  EOG_R poor quality
12:18:58  0:11:32  [ PI]  O1_A2 poor quality
12:19:30  0:12:04  [ PI]  O1_A2 poor quality
12:19:31  0:12:04  [ PI]  O2_A1 poor quality
12:19:35  0:12:09  [ PI]  EOG_L poor quality
12:19:39  0:12:11  5:O2_A1
12:19:41  0:12:13  [ PI]  EOG_R poor quality
12:19:44  0:12:14  4:O1_A2
12:20:12  0:12:42  [ PI]  O2_A1 poor quality
12:20:24  0:12:49  5:O2_A1   Other: saturation
12:20:50  0:13:15  [ PI]  O1_A2 poor quality
12:20:50  0:13:15  [ PI]  O2_A1 poor quality
12:20:54  0:13:19  [ PI]  C4_A1 poor quality
12:20:55  0:13:20  [ PI]  EOG_R poor quality
12:21:01  0:13:23  3:C4_A1   Popping
12:21:10  0:13:26  4:O1_A2   Other: saturation
12:21:20  0:13:36  [ PI]  O2_A1 poor quality
12:21:26  0:13:42  [ PI]  O1_A2 poor quality
12:21:34  0:13:50  [ PI]  EOG_R poor quality
12:21:39  0:13:51  4:O1_A2   Popping
12:21:43  0:13:54  [ PI]  O1_A2 poor quality
12:21:52  0:14:02  4:O1_A2   Popping
12:22:15  0:14:25  [ PI]  O2_A1 poor quality
12:22:37  0:14:42  4:O1_A2   Other: saturation
12:22:48  0:14:52  5:O2_A1   Popping
12:23:14  0:15:18  [ PI]  O1_A2 poor quality
12:23:16  0:15:20  [ PI]  O2_A1 poor quality
12:23:18  0:15:22  [ PI]  C3_A2 poor quality
12:23:19  0:15:23  [ PI]  C4_A1 poor quality
```

sub06111.txt

```
Data file used:   C:/PI/DATAFILE/RICK_6~1.VPD
10:09:36  0:00:19  [ PI]  O1_A2 poor quality
10:09:37  0:00:19  [ PI]  C4_A1 poor quality
10:09:37  0:00:19  [ PI]  O2_A1 poor quality
10:09:51  0:00:34  [ PI]  O2_A1 poor quality
10:09:52  0:00:35  [ PI]  EKG poor quality
10:10:18  0:00:54  4:O1_A2   Flat
10:10:33  0:00:59  4:O1_A2   Flat
10:10:43  0:01:05  4:O1_A2   Popping
10:10:50  0:01:12  [ PI]  O1_A2 poor quality
10:10:51  0:01:13  [ PI]  EKG poor quality
10:11:00  0:01:16  4:O1_A2   Popping
10:11:01  0:01:17  [ PI]  O2_A1 poor quality
10:11:42  0:01:21  EKG   Noise
10:12:17  0:01:22  4:O1_A2   Flat
10:12:36  0:01:35  4:O1_A2   Noise
10:12:37  0:01:36  [ PI]  O2_A1 poor quality
10:12:38  0:01:37  [ PI]  O1_A2 poor quality
10:12:52  0:01:38  4:O1_A2   Popping
10:13:15  0:01:43  5:O2_A1   Flat
10:13:27  0:01:54  [ PI]  O1_A2 poor quality
```

```
10:13:31  0:01:58  [PI]  O2_A1 poor quality
10:13:36  0:02:01  4:O1_A2   Flat
10:13:44  0:02:08  [PI]  O1_A2 poor quality
10:14:09  0:02:22  4:O1_A2   Flat
10:14:21  0:02:34  [PI]  EKG poor quality
10:14:21  0:02:34  [PI]  O2_A1 poor quality
10:14:55  0:02:50  4:O1_A2   Flat
10:15:07  0:02:53  EKG   Noise
10:15:14  0:02:57  5:O2_A1   Popping
10:15:18  0:03:00  [PI]  O2_A1 poor quality
10:15:26  0:03:04  4:O1_A2   Flat
10:15:49  0:03:06  5:O2_A1   Popping Noise
10:16:03  0:03:15  4:O1_A2   Popping Flat
10:16:14  0:03:23  4:O1_A2   Popping Flat
10:16:16  0:03:25  [PI]  EKG poor quality
10:16:21  0:03:30  [PI]  O2_A1 poor quality
10:16:23  0:03:32  [PI]  C4_A1 poor quality
10:16:34  0:03:37  EKG   Noise
10:17:26  0:03:38  5:O2_A1   Popping Noise
10:17:42  0:03:40  [PI]  C3_A2 poor quality
10:17:49  0:03:44  4:O1_A2   Flat
10:18:04  0:03:46  2:C3_A2   Popping Flat
10:18:08  0:03:50  [PI]  O2_A1 poor quality
10:18:37  0:03:57  4:O1_A2   Popping Flat
10:19:05  0:04:01  2:C3_A2   Popping
10:19:11  0:04:06  [PI]  O2_A1 poor quality
10:19:20  0:04:09  5:O2_A1   Popping
10:19:34  0:04:17  4:O1_A2   Flat
10:19:47  0:04:22  4:O1_A2   Flat
10:20:14  0:04:32  7:EOG_R
10:20:15  0:04:33  [PI]  O1_A2 poor quality
10:20:16  0:04:34  [PI]  O2_A1 poor quality
10:20:28  0:04:39  5:O2_A1   Popping Flat
10:20:59  0:04:49  5:O2_A1   Flat
10:21:04  0:04:54  [PI]  O2_A1 poor quality
10:21:20  0:05:01  7:EOG_R
10:21:24  0:05:05  [PI]  EKG poor quality
10:21:34  0:05:11  EKG   Noise
10:21:37  0:05:14  [PI]  O2_A1 poor quality
10:21:56  0:05:17  5:O2_A1   Popping
10:22:01  0:05:18  3:C4_A1   Popping
10:22:07  0:05:22  2:C3_A2   Popping
10:22:08  0:05:24  [PI]  C4_A1 poor quality
10:22:11  0:05:25  4:O1_A2   Popping
10:22:12  0:05:25  [PI]  C3_A2 poor quality
10:22:42  0:05:29  6:EOG_L
10:22:53  0:05:32  7:EOG_R   Popping
10:23:03  0:05:39  2:C3_A2   Popping
10:23:15  0:05:42  3:C4_A1   Popping
10:23:23  0:05:45  3:C4_A1   Popping
10:23:45  0:05:49  5:O2_A1   Popping
10:23:58  0:06:00  4:O1_A2   Flat
10:27:45  0:06:40  4:O1_A2   Flat
10:27:49  0:06:43  [PI]  O1_A2 poor quality
10:27:57  0:06:48  5:O2_A1   Popping
10:28:02  0:06:52  4:O1_A2   Flat
10:28:09  0:06:58  [PI]  C3_A2 poor quality
10:28:16  0:07:00  2:C3_A2   Popping Noise
10:28:17  0:07:02  [PI]  EOG_L poor quality
10:28:36  0:07:05  6:EOG_L   Flat
10:28:45  0:07:14  [PI]  O1_A2 poor quality
10:28:53  0:07:16  2:C3_A2   Flat Noise
10:29:02  0:07:19  3:C4_A1   Popping
10:29:16  0:07:22  4:O1_A2   Flat Noise
10:29:22  0:07:29  [PI]  O1_A2 poor quality
10:29:23  0:07:30  [PI]  O2_A1 poor quality
10:29:33  0:07:36  EKG   Noise
10:29:49  0:07:48  5:O2_A1   Flat
10:29:59  0:07:58  [PI]  O1_A2 poor quality
10:30:04  0:07:59  4:O1_A2   Flat
10:30:08  0:08:03  [PI]  EOG_L poor quality
```

10:30:13 0:08:08 [PI] EOG_R poor quality
10:30:19 0:08:12 2:C3_A2   Noise
10:30:21 0:08:13 [PI] O1_A2 poor quality
10:30:26 0:08:18 [PI] EOG_R poor quality
10:30:33 0:08:23 3:C4_A1   Noise
10:30:39 0:08:26 5:O2_A1   Noise
10:30:40 0:08:27 [PI] EOG_L poor quality
10:30:41 0:08:28 [PI] EOG_R poor quality
10:30:52 0:08:39 [PI] O2_A1 poor quality
10:31:04 0:08:45 4:O1_A2   Flat Noise
10:31:21 0:08:48 2:C3_A2   Noise
10:31:25 0:08:51 5:O2_A1   Flat
10:31:34 0:08:58 2:C3_A2   Noise
10:31:35 0:08:58 [PI] O2_A1 poor quality
10:31:38 0:08:59 4:O1_A2   Noise
10:31:46 0:09:07 [PI] EOG_R poor quality
10:31:56 0:09:08 5:O2_A1   Popping
10:32:00 0:09:12 [PI] EOG_L poor quality
10:32:11 0:09:20 7:EOG_R   Flat
10:32:23 0:09:28 10:EMGlsm
10:32:30 0:09:33 4:O1_A2   Noise
10:32:35 0:09:36 2:C3_A2   Noise
10:32:53 0:09:46 2:C3_A2   Popping Noise
10:32:57 0:09:48 4:O1_A2   Noise
10:33:02 0:09:52 [PI] O1_A2 poor quality
10:33:02 0:09:52 [PI] O2_A1 poor quality
10:33:11 0:09:59 5:O2_A1   Flat
10:33:26 0:10:10 2:C3_A2   Noise
10:33:33 0:10:16 [PI] O2_A1 poor quality
10:33:38 0:10:18 5:O2_A1   Popping
10:33:38 0:10:18 [PI] O1_A2 poor quality
10:33:42 0:10:19 3:C4_A1   Popping
10:33:49 0:10:22 2:C3_A2   Popping Noise
10:33:54 0:10:23 4:O1_A2   Popping Noise
10:34:00 0:10:28 5:O2_A1   Flat
10:34:12 0:10:38 4:O1_A2   Noise
10:34:13 0:10:39 [PI] O1_A2 poor quality
10:34:14 0:10:40 [PI] O2_A1 poor quality
10:34:20 0:10:44 [PI] EOG_L poor quality
10:34:20 0:10:44 [PI] EOG_R poor quality
10:34:33 0:10:45 5:O2_A1   Popping Flat
10:34:46 0:10:47 3:C4_A1   Popping
10:35:02 0:10:57 5:O2_A1   Popping
10:35:17 0:11:09 4:O1_A2   Flat
10:35:29 0:11:18 5:O2_A1   Flat
10:35:43 0:11:30 2:C3_A2   Noise
10:35:45 0:11:32 [PI] O1_A2 poor quality
10:35:54 0:11:38 4:O1_A2   Flat
10:36:21 0:12:02 6:EOG_L   Noise
10:36:22 0:12:04 [PI] O1_A2 poor quality
10:36:22 0:12:04 [PI] O2_A1 poor quality
10:36:39 0:12:08 5:O2_A1   Popping Flat
10:36:41 0:12:09 [PI] EOG_L poor quality
10:36:45 0:12:13 [PI] EOG_R poor quality
10:37:08 0:12:18 5:O2_A1   Popping
10:37:31 0:12:40 2:C3_A2   Noise
10:37:34 0:12:42 [PI] O2_A1 poor quality
10:38:03 0:13:09 6:EOG_L   Noise
10:38:09 0:13:15 [PI] O1_A2 poor quality
10:38:09 0:13:15 [PI] O2_A1 poor quality
10:38:13 0:13:19 [PI] C4_A1 poor quality
10:38:14 0:13:20 [PI] EOG_R poor quality
10:38:17 0:13:21 5:O2_A1   Flat
10:38:31 0:13:30 5:O2_A1   Flat
10:38:37 0:13:36 [PI] O2_A1 poor quality
10:38:47 0:13:40 5:O2_A1   Flat
10:38:50 0:13:42 [PI] O1_A2 poor quality
10:39:00 0:13:49 5:O2_A1   Popping
10:39:01 0:13:50 [PI] EOG_R poor quality
10:39:05 0:13:54 [PI] O1_A2 poor quality
10:39:21 0:14:09 4:O1_A2   Flat

```
10:39:34  0:14:19  4:O1_A2   Flat
10:39:40  0:14:25  [ PI]  O2_A1 poor quality
10:39:47  0:14:30  5:O2_A1   Flat
10:40:02  0:14:39  5:O2_A1   Popping
10:40:26  0:14:58  5:O2_A1   Popping
10:40:47  0:15:18  [ PI]  O1_A2 poor quality
10:40:49  0:15:20  [ PI]  O2_A1 poor quality
10:40:53  0:15:22  4:O1_A2   Flat
10:40:53  0:15:22  [ PI]  C3_A2 poor quality
10:40:54  0:15:23  [ PI]  C4_A1 poor quality
10:41:03  0:15:24  2:C3_A2   Popping
10:41:15  0:15:26  3:C4_A1   Popping
10:41:19  0:15:26  5:O2_A1   Popping
10:41:58  0:15:26  11:EMGrsm
```

sub06120.txt

```
10:03:18  0:00:06  2:C3_A2   Popping
10:03:34  0:00:18  4:O1_A2   Popping
10:03:35  0:00:19  [ PI]  O1_A2 poor quality
10:03:35  0:00:19  [ PI]  C4_A1 poor quality
10:03:35  0:00:19  [ PI]  O2_A1 poor quality
10:03:49  0:00:30  2:C3_A2   Noise
10:03:53  0:00:34  [ PI]  O2_A1 poor quality
10:03:54  0:00:35  [ PI]  EKG poor quality
10:03:59  0:00:37  EKG   Noise
10:04:14  0:00:48  4:O1_A2   Flat
10:04:57  0:00:58  5:O2_A1
10:05:02  0:01:00  4:O1_A2   Flat
10:05:14  0:01:12  [ PI]  O1_A2 poor quality
10:05:15  0:01:13  [ PI]  EKG poor quality
10:05:26  0:01:17  2:C3_A2   Popping
10:05:26  0:01:17  [ PI]  O2_A1 poor quality
10:05:43  0:01:29  6:EOG_L   Noise
10:05:50  0:01:36  [ PI]  O2_A1 poor quality
10:05:51  0:01:37  [ PI]  O1_A2 poor quality
10:06:12  0:01:39  5:O2_A1
10:06:15  0:01:40  5:O2_A1   Flat
10:06:44  0:01:49  4:O1_A2
10:06:52  0:01:51  6:EOG_L   Noise
10:06:55  0:01:54  [ PI]  O1_A2 poor quality
10:07:16  0:01:57  7:EOG_R
10:07:17  0:01:58  [ PI]  O2_A1 poor quality
10:07:20  0:01:59  4:O1_A2   Flat
10:07:29  0:02:08  [ PI]  O1_A2 poor quality
10:07:37  0:02:10  5:O2_A1   Popping Noise
10:08:06  0:02:20  11:EMGrsm
10:08:11  0:02:21  5:O2_A1   Popping
10:08:22  0:02:29  5:O2_A1   Popping
10:08:27  0:02:34  [ PI]  EKG poor quality
10:08:27  0:02:34  [ PI]  O2_A1 poor quality
10:08:40  0:02:40  EKG   Noise
10:08:52  0:02:49  EKG   Noise
10:09:03  0:03:00  [ PI]  O2_A1 poor quality
10:09:05  0:03:01  EKG   Noise
10:09:17  0:03:09  5:O2_A1   Popping
10:09:33  0:03:24  EKG   Noise
10:09:34  0:03:25  [ PI]  EKG poor quality
10:09:42  0:03:30  6:EOG_L   Noise
10:09:42  0:03:30  [ PI]  O2_A1 poor quality
10:09:44  0:03:32  [ PI]  C4_A1 poor quality
10:09:53  0:03:38  EKG   Noise
10:09:55  0:03:40  [ PI]  C3_A2 poor quality
10:10:05  0:03:50  [ PI]  O2_A1 poor quality
10:10:09  0:03:51  EKG   Noise
10:10:36  0:04:01  6:EOG_L
10:10:41  0:04:06  [ PI]  O2_A1 poor quality
10:10:46  0:04:07  5:O2_A1   Popping
10:11:04  0:04:18  5:O2_A1
10:11:07  0:04:20  2:C3_A2   Noise
```

```
10:11:24  0:04:29  7:EOG_R
10:11:27  0:04:30  2:C3_A2   Noise
10:11:30  0:04:33  [PI]  O1_A2 poor quality
10:11:31  0:04:34  [PI]  O2_A1 poor quality
10:11:45  0:04:43  7:EOG_R
10:12:00  0:04:48  5:O2_A1   Popping Flat
10:12:07  0:04:53  EKG   Noise
10:12:08  0:04:54  [PI]  O2_A1 poor quality
10:12:17  0:05:00  7:EOG_R
10:12:21  0:05:02  5:O2_A1   Flat
10:12:24  0:05:05  [PI]  EKG poor quality
10:12:30  0:05:08  EKG   Noise
10:12:36  0:05:14  [PI]  O2_A1 poor quality
10:12:48  0:05:19  EKG   Noise
10:12:53  0:05:24  [PI]  C4_A1 poor quality
10:12:54  0:05:25  [PI]  C3_A2 poor quality
10:13:05  0:05:29  5:O2_A1   Popping Noise
10:13:35  0:05:58  4:O1_A2   Flat
10:14:21  0:06:39  2:C3_A2   Noise
10:14:25  0:06:43  [PI]  O1_A2 poor quality
10:14:33  0:06:49  6:EOG_L   Noise
10:14:42  0:06:58  [PI]  C3_A2 poor quality
10:14:47  0:06:59  2:C3_A2   Popping Noise
10:14:51  0:07:02  [PI]  EOG_L poor quality
10:15:06  0:07:08  7:EOG_R
10:15:16  0:07:10  6:EOG_L   Flat
10:15:20  0:07:14  [PI]  O1_A2 poor quality
10:15:33  0:07:18  2:C3_A2   Flat Noise
10:15:44  0:07:29  [PI]  O1_A2 poor quality
10:15:55  0:07:30  5:O2_A1   Popping
10:15:55  0:07:30  [PI]  O2_A1 poor quality
10:15:59  0:07:31  2:C3_A2   Noise
10:16:12  0:07:41  6:EOG_L
10:16:29  0:07:58  [PI]  O1_A2 poor quality
10:16:34  0:08:03  [PI]  EOG_L poor quality
10:16:39  0:08:08  [PI]  EOG_R poor quality
10:16:44  0:08:13  [PI]  O1_A2 poor quality
10:16:49  0:08:18  [PI]  EOG_R poor quality
10:16:58  0:08:27  [PI]  EOG_L poor quality
10:16:59  0:08:28  [PI]  EOG_R poor quality
10:17:10  0:08:39  [PI]  O2_A1 poor quality
10:17:13  0:08:40  5:O2_A1   Flat
10:17:23  0:08:48  5:O2_A1   Flat
10:17:34  0:08:58  [PI]  O2_A1 poor quality
10:17:43  0:09:05  7:EOG_R   Popping
10:17:45  0:09:07  [PI]  EOG_R poor quality
10:17:55  0:09:10  6:EOG_L
10:17:56  0:09:12  [PI]  EOG_L poor quality
10:18:11  0:09:19  10:EMGlsm
10:18:17  0:09:21  3:C4_A1   Noise
10:18:27  0:09:30  2:C3_A2   Noise
10:18:49  0:09:49  6:EOG_L   Noise
10:18:53  0:09:52  [PI]  O1_A2 poor quality
10:18:53  0:09:52  [PI]  O2_A1 poor quality
10:19:10  0:10:06  2:C3_A2   Noise
10:19:20  0:10:16  [PI]  O2_A1 poor quality
10:19:22  0:10:18  [PI]  O1_A2 poor quality
10:19:32  0:10:23  6:EOG_L   Noise
10:19:38  0:10:27  5:O2_A1   Flat
10:19:44  0:10:32  2:C3_A2   Noise
10:19:52  0:10:39  [PI]  O1_A2 poor quality
10:19:55  0:10:40  6:EOG_L   Noise
10:19:55  0:10:40  [PI]  O2_A1 poor quality
10:19:59  0:10:44  [PI]  EOG_L poor quality
10:19:59  0:10:44  [PI]  EOG_R poor quality
10:20:21  0:11:00  EKG
10:20:30  0:11:04  6:EOG_L   Noise
10:20:43  0:11:15  5:O2_A1   Flat
10:20:52  0:11:21  6:EOG_L   Noise
10:21:03  0:11:30  2:C3_A2   Noise
10:21:06  0:11:32  [PI]  O1_A2 poor quality
```

```
10:21:18  0:11:42  4:O1_A2   Flat
10:21:38  0:11:59  6:EOG_L   Noise
10:21:43  0:12:04  [PI]  O1_A2 poor quality
10:21:43  0:12:04  [PI]  O2_A1 poor quality
10:21:49  0:12:09  4:O1_A2   Flat
10:21:50  0:12:09  [PI]  EOG_L poor quality
10:21:54  0:12:13  [PI]  EOG_R poor quality
10:22:23  0:12:39  6:EOG_L   Noise
10:22:25  0:12:42  [PI]  O2_A1 poor quality
10:22:47  0:13:02  2:C3_A2   Noise
10:23:01  0:13:10  6:EOG_L   Noise
10:23:06  0:13:15  [PI]  O1_A2 poor quality
10:23:06  0:13:15  [PI]  O2_A1 poor quality
10:23:10  0:13:19  [PI]  C4_A1 poor quality
10:23:13  0:13:20  5:O2_A1   Flat
10:23:14  0:13:20  [PI]  EOG_R poor quality
10:23:30  0:13:36  [PI]  O2_A1 poor quality
10:23:37  0:13:41  5:O2_A1   Flat
10:23:38  0:13:42  [PI]  O1_A2 poor quality
10:23:46  0:13:50  [PI]  EOG_R poor quality
10:23:50  0:13:54  [PI]  O1_A2 poor quality
10:24:07  0:14:09  4:O1_A2   Flat
10:24:23  0:14:25  [PI]  O2_A1 poor quality
10:24:31  0:14:26  5:O2_A1   Popping Flat
10:25:08  0:14:57  5:O2_A1
10:25:28  0:15:18  [PI]  O1_A2 poor quality
10:25:30  0:15:20  [PI]  O2_A1 poor quality
10:25:32  0:15:22  [PI]  C3_A2 poor quality
10:25:33  0:15:23  [PI]  C4_A1 poor quality
```

sub07111.txt

```
Data file used:   C:/PI/DATAFILE/RICK_6~1.VPD
9:13:17  0:00:19  [PI]  O1_A2 poor quality
9:13:17  0:00:19  [PI]  C4_A1 poor quality
9:13:17  0:00:19  [PI]  O2_A1 poor quality
9:13:28  0:00:25  4:O1_A2   Popping
9:13:37  0:00:28  3:C4_A1   Popping
9:13:43  0:00:34  [PI]  O2_A1 poor quality
9:13:44  0:00:35  [PI]  EKG poor quality
9:13:52  0:00:36  5:O2_A1   Popping
9:14:03  0:00:40  EKG   Noise
9:14:07  0:00:41  4:O1_A2   Popping
9:14:17  0:00:48  4:O1_A2   Flat
9:14:36  0:01:05  4:O1_A2   Popping
9:14:42  0:01:12  [PI]  O1_A2 poor quality
9:14:43  0:01:13  [PI]  EKG poor quality
9:14:48  0:01:16  EKG   Noise
9:14:49  0:01:17  [PI]  O2_A1 poor quality
9:14:54  0:01:19  5:O2_A1   Popping
9:15:11  0:01:36  [PI]  O2_A1 poor quality
9:15:12  0:01:37  [PI]  O1_A2 poor quality
9:15:21  0:01:38  5:O2_A1   Flat
9:15:37  0:01:54  [PI]  O1_A2 poor quality
9:15:41  0:01:58  [PI]  O2_A1 poor quality
9:15:44  0:02:00  5:O2_A1   Popping
9:15:49  0:02:03  4:O1_A2   Popping
9:15:55  0:02:08  [PI]  O1_A2 poor quality
9:16:21  0:02:34  [PI]  EKG poor quality
9:16:21  0:02:34  [PI]  O2_A1 poor quality
9:16:27  0:02:36  5:O2_A1   Popping
9:16:32  0:02:38  EKG   Noise
9:16:54  0:03:00  [PI]  O2_A1 poor quality
9:16:59  0:03:02  5:O2_A1   Popping
9:17:23  0:03:25  [PI]  EKG poor quality
9:17:28  0:03:30  [PI]  O2_A1 poor quality
9:17:30  0:03:32  [PI]  C4_A1 poor quality
9:17:39  0:03:33  EKG   Noise
9:17:57  0:03:38  3:C4_A1   Popping
9:18:01  0:03:39  5:O2_A1   Popping
```

```
9:18:01  0:03:40  [PI]  C3_A2 poor quality
9:18:14  0:03:43  2:C3_A2   Flat
9:18:21  0:03:50  [PI]  O2_A1 poor quality
9:18:25  0:03:52  5:O2_A1   Popping
9:18:29  0:03:54  2:C3_A2   Popping
9:18:41  0:04:06  [PI]  O2_A1 poor quality
9:18:44  0:04:08  5:O2_A1   Popping
9:19:09  0:04:33  [PI]  O1_A2 poor quality
9:19:10  0:04:34  [PI]  O2_A1 poor quality
9:19:21  0:04:36  4:O1_A2   Popping
9:19:24  0:04:37  5:O2_A1   Popping
9:19:41  0:04:54  [PI]  O2_A1 poor quality
9:19:50  0:04:56  5:O2_A1   Popping
9:20:02  0:05:01  5:O2_A1   Popping
9:20:06  0:05:05  [PI]  EKG poor quality
9:20:13  0:05:09  EKG   Noise
9:20:19  0:05:14  [PI]  O2_A1 poor quality
9:20:23  0:05:16  5:O2_A1   Popping
9:20:32  0:05:22  5:O2_A1   Popping
9:20:36  0:05:24  4:O1_A2   Popping
9:20:36  0:05:24  [PI]  C4_A1 poor quality
9:20:37  0:05:25  [PI]  C3_A2 poor quality
9:20:40  0:05:26  2:C3_A2   Popping
9:20:42  0:05:28  3:C4_A1   Popping
9:20:45  0:05:29  5:O2_A1   Popping
9:21:59  0:06:43  [PI]  O1_A2 poor quality
9:22:03  0:06:45  4:O1_A2   Popping
9:22:17  0:06:58  [PI]  C3_A2 poor quality
9:22:21  0:06:59  2:C3_A2   Popping
9:22:24  0:07:02  [PI]  EOG_L poor quality
9:22:27  0:07:04  6:EOG_L   Popping
9:22:31  0:07:06  2:C3_A2   Popping
9:22:39  0:07:14  [PI]  O1_A2 poor quality
9:22:43  0:07:16  4:O1_A2   Popping
9:22:57  0:07:29  [PI]  O1_A2 poor quality
9:22:58  0:07:30  [PI]  O2_A1 poor quality
9:23:01  0:07:31  4:O1_A2   Popping
9:23:07  0:07:35  5:O2_A1   Popping
9:23:30  0:07:58  [PI]  O1_A2 poor quality
9:23:34  0:08:00  4:O1_A2   Popping
9:23:37  0:08:03  [PI]  EOG_L poor quality
9:23:49  0:08:05  6:EOG_L   Other: saturation
9:23:53  0:08:08  [PI]  EOG_R poor quality
9:24:02  0:08:11  7:EOG_R   Other: saturation
9:24:04  0:08:13  [PI]  O1_A2 poor quality
9:24:09  0:08:18  [PI]  EOG_R poor quality
9:24:26  0:08:21  7:EOG_R
9:24:38  0:08:24  4:O1_A2   Flat
9:24:42  0:08:27  [PI]  EOG_L poor quality
9:24:43  0:08:28  [PI]  EOG_R poor quality
9:24:46  0:08:30  6:EOG_L
9:24:52  0:08:33  7:EOG_R
9:24:58  0:08:39  [PI]  O2_A1 poor quality
9:25:10  0:08:42  5:O2_A1   Other: saturation
9:25:16  0:08:46  5:O2_A1   Flat
9:25:28  0:08:58  [PI]  O2_A1 poor quality
9:25:32  0:09:00  5:O2_A1   Flat
9:25:39  0:09:07  [PI]  EOG_R poor quality
9:25:45  0:09:09  7:EOG_R
9:25:47  0:09:12  [PI]  EOG_L poor quality
9:25:54  0:09:17  6:EOG_L
9:26:28  0:09:52  [PI]  O1_A2 poor quality
9:26:29  0:09:52  [PI]  O2_A1 poor quality
9:26:44  0:09:55  5:O2_A1
9:26:47  0:09:56  4:O1_A2   Popping
9:27:07  0:10:16  [PI]  O2_A1 poor quality
9:27:17  0:10:18  5:O2_A1   Popping
9:27:17  0:10:18  [PI]  O1_A2 poor quality
9:27:22  0:10:20  4:O1_A2   Popping
9:27:36  0:10:32  4:O1_A2   Noise
9:27:40  0:10:35  2:C3_A2   Noise
```

```
9:27:45  0:10:39  [PI]  O1_A2 poor quality
9:27:46  0:10:40  [PI]  O2_A1 poor quality
9:27:49  0:10:41  4:O1_A2   Popping
9:27:52  0:10:44  [PI]  EOG_L poor quality
9:27:52  0:10:44  [PI]  EOG_R poor quality
9:27:55  0:10:45  5:O2_A1   Popping
9:28:05  0:10:49  6:EOG_L
9:28:07  0:10:51  7:EOG_R
9:28:49  0:11:32  [PI]  O1_A2 poor quality
9:28:52  0:11:33  4:O1_A2   Popping
9:28:56  0:11:37  5:O2_A1   Popping
9:29:24  0:12:04  [PI]  O1_A2 poor quality
9:29:24  0:12:04  [PI]  O2_A1 poor quality
9:29:32  0:12:05  5:O2_A1   Popping
9:29:35  0:12:06  4:O1_A2   Popping
9:29:38  0:12:09  [PI]  EOG_L poor quality
9:29:42  0:12:11  6:EOG_L
9:29:45  0:12:13  [PI]  EOG_R poor quality
9:29:48  0:12:16  7:EOG_R
9:30:15  0:12:42  [PI]  O2_A1 poor quality
9:30:18  0:12:44  5:O2_A1   Flat
9:30:50  0:13:15  [PI]  O1_A2 poor quality
9:30:50  0:13:15  [PI]  O2_A1 poor quality
9:30:56  0:13:18  5:O2_A1   Popping
9:30:58  0:13:19  4:O1_A2   Popping
9:30:59  0:13:19  [PI]  C4_A1 poor quality
9:31:00  0:13:20  [PI]  EOG_R poor quality
9:31:02  0:13:21  3:C4_A1   Popping
9:31:08  0:13:23  7:EOG_R   Popping
9:31:12  0:13:25  6:EOG_L   Popping
9:31:23  0:13:36  [PI]  O2_A1 poor quality
9:31:28  0:13:38  5:O2_A1   Popping
9:31:32  0:13:42  [PI]  O1_A2 poor quality
9:31:37  0:13:44  4:O1_A2   Popping
9:31:43  0:13:50  [PI]  EOG_R poor quality
9:31:57  0:13:52  7:EOG_R
9:31:59  0:13:54  [PI]  O1_A2 poor quality
9:32:05  0:13:59  4:O1_A2   Popping
9:32:32  0:14:25  [PI]  O2_A1 poor quality
9:32:41  0:14:27  5:O2_A1   Other: saturation
9:32:54  0:14:38  5:O2_A1   Popping
9:32:56  0:14:40  4:O1_A2   Popping
9:33:34  0:15:18  [PI]  O1_A2 poor quality
9:33:36  0:15:20  [PI]  O2_A1 poor quality
9:33:40  0:15:22  5:O2_A1   Popping
9:33:41  0:15:22  [PI]  C3_A2 poor quality
9:33:43  0:15:23  4:O1_A2   Popping
9:33:44  0:15:23  [PI]  C4_A1 poor quality
9:33:47  0:15:25  3:C4_A1   Popping
9:33:50  0:15:26  2:C3_A2   Popping
9:34:05  0:15:26  3:C4_A1
```

sub07120.txt

```
9:05:39  0:00:19  [PI]  O1_A2 poor quality
9:05:39  0:00:19  [PI]  C4_A1 poor quality
9:05:39  0:00:19  [PI]  O2_A1 poor quality
9:05:43  0:00:21  4:O1_A2   Popping
9:05:49  0:00:24  2:C3_A2
9:05:54  0:00:25  3:C4_A1   Popping
9:06:02  0:00:34  [PI]  O2_A1 poor quality
9:06:05  0:00:35  4:O1_A2   Popping
9:06:05  0:00:35  [PI]  EKG poor quality
9:06:07  0:00:36  2:C3_A2   Popping
9:06:12  0:00:37  3:C4_A1   Popping
9:06:20  0:00:38  5:O2_A1   Popping
9:06:24  0:00:40  EKG   Noise
9:06:36  0:00:49  4:O1_A2   Flat
9:07:43  0:01:00  4:O1_A2   Other: Other
9:07:54  0:01:10  4:O1_A2   Popping
```

```
9:07:56  0:01:12  [ PI]  O1_A2 poor quality
9:07:57  0:01:13  [ PI]  EKG poor quality
9:08:01  0:01:14  EKG   Noise
9:08:04  0:01:15  5:O2_A1   Popping
9:08:07  0:01:16  3:C4_A1   Popping
9:08:07  0:01:17  [ PI]  O2_A1 poor quality
9:08:10  0:01:18  2:C3_A2   Popping
9:08:12  0:01:19  4:O1_A2   Popping
9:08:30  0:01:25  2:C3_A2   Noise
9:08:34  0:01:27  4:O1_A2   Popping
9:08:43  0:01:36  [ PI]  O2_A1 poor quality
9:08:44  0:01:37  [ PI]  O1_A2 poor quality
9:09:01  0:01:54  [ PI]  O1_A2 poor quality
9:09:05  0:01:57  4:O1_A2   Popping
9:09:08  0:01:58  2:C3_A2   Popping
9:09:08  0:01:58  [ PI]  O2_A1 poor quality
9:09:10  0:01:59  3:C4_A1   Popping
9:09:20  0:02:00  5:O2_A1   Popping
9:09:28  0:02:08  [ PI]  O1_A2 poor quality
9:09:32  0:02:09  4:O1_A2   Popping
9:09:35  0:02:10  2:C3_A2   Popping
9:09:38  0:02:12  3:C4_A1   Popping
9:09:42  0:02:13  5:O2_A1   Popping
9:10:05  0:02:29  4:O1_A2   Popping
9:10:07  0:02:30  3:C4_A1   Popping
9:10:10  0:02:31  5:O2_A1   Popping
9:10:13  0:02:34  [ PI]  EKG poor quality
9:10:13  0:02:34  [ PI]  O2_A1 poor quality
9:10:17  0:02:36  EKG   Noise
9:10:20  0:02:37  5:O2_A1   Popping
9:10:22  0:02:38  3:C4_A1   Popping
9:10:24  0:02:39  2:C3_A2   Popping
9:10:26  0:02:40  4:O1_A2   Popping
9:10:47  0:02:58  4:O1_A2   Popping
9:10:52  0:03:00  5:O2_A1   Popping
9:10:52  0:03:00  [ PI]  O2_A1 poor quality
9:10:56  0:03:03  2:C3_A2   Popping
9:10:58  0:03:05  3:C4_A1   Popping
9:11:08  0:03:14  4:O1_A2   Popping
9:11:09  0:03:15  2:C3_A2   Popping
9:11:14  0:03:16  3:C4_A1
9:11:16  0:03:17  5:O2_A1
9:11:24  0:03:24  EKG   Noise
9:11:25  0:03:25  [ PI]  EKG poor quality
9:11:33  0:03:27  2:C3_A2   Noise
9:11:38  0:03:30  4:O1_A2   Popping
9:11:38  0:03:30  [ PI]  O2_A1 poor quality
9:11:40  0:03:32  [ PI]  C4_A1 poor quality
9:11:41  0:03:33  5:O2_A1   Popping
9:11:43  0:03:34  3:C4_A1   Popping
9:11:50  0:03:39  5:O2_A1   Popping
9:11:52  0:03:40  3:C4_A1   Popping
9:11:52  0:03:40  [ PI]  C3_A2 poor quality
9:12:01  0:03:43  4:O1_A2   Popping
9:12:03  0:03:44  2:C3_A2   Popping
9:12:09  0:03:50  [ PI]  O2_A1 poor quality
9:12:14  0:03:54  4:O1_A2   Popping
9:12:16  0:03:55  2:C3_A2   Popping
9:12:21  0:03:56  3:C4_A1   Popping
9:12:23  0:03:57  5:O2_A1   Popping
9:12:33  0:04:06  [ PI]  O2_A1 poor quality
9:12:34  0:04:07  4:O1_A2   Popping
9:12:37  0:04:08  2:C3_A2   Popping
9:12:39  0:04:10  3:C4_A1   Popping
9:12:42  0:04:11  5:O2_A1   Popping
9:12:59  0:04:27  4:O1_A2   Noise
9:13:02  0:04:28  2:C3_A2   Noise
9:13:07  0:04:33  [ PI]  O1_A2 poor quality
9:13:08  0:04:34  [ PI]  O2_A1 poor quality
9:13:12  0:04:36  5:O2_A1   Popping
9:13:15  0:04:38  3:C4_A1   Popping
```

9:13:19	0:04:40	4:O1_A2 Popping
9:13:30	0:04:45	4:O1_A2
9:13:38	0:04:54	[PI] O2_A1 poor quality
9:13:50	0:04:59	5:O2_A1
9:13:56	0:05:05	[PI] EKG poor quality
9:14:04	0:05:09	4:O1_A2 Popping Noise
9:14:08	0:05:10	2:C3_A2 Popping Noise
9:14:13	0:05:13	5:O2_A1 Popping
9:14:16	0:05:14	3:C4_A1 Popping
9:14:16	0:05:14	[PI] O2_A1 poor quality
9:14:19	0:05:15	2:C3_A2 Popping
9:14:23	0:05:16	4:O1_A2 Popping
9:14:31	0:05:24	[PI] C4_A1 poor quality
9:14:32	0:05:25	[PI] C3_A2 poor quality
9:14:47	0:05:35	3:C4_A1 Popping
9:14:50	0:05:37	5:O2_A1 Popping
9:14:59	0:05:45	4:O1_A2
9:15:16	0:05:59	4:O1_A2
9:15:30	0:06:10	2:C3_A2 Noise
9:15:32	0:06:12	4:O1_A2 Noise
9:16:03	0:06:43	[PI] O1_A2 poor quality
9:16:15	0:06:54	4:O1_A2 Noise
9:16:18	0:06:55	2:C3_A2 Noise
9:16:21	0:06:58	[PI] C3_A2 poor quality
9:16:25	0:06:59	2:C3_A2 Popping
9:16:30	0:07:01	3:C4_A1 Popping
9:16:31	0:07:02	[PI] EOG_L poor quality
9:17:13	0:07:05	7:EOG_R
9:17:21	0:07:08	7:EOG_R
9:17:28	0:07:14	[PI] O1_A2 poor quality
9:17:41	0:07:26	4:O1_A2 Noise
9:17:44	0:07:27	2:C3_A2 Noise
9:17:46	0:07:29	[PI] O1_A2 poor quality
9:17:47	0:07:30	[PI] O2_A1 poor quality
9:17:53	0:07:33	4:O1_A2 Popping
9:17:55	0:07:34	2:C3_A2 Popping
9:17:57	0:07:35	3:C4_A1 Popping
9:18:00	0:07:36	5:O2_A1 Popping
9:18:21	0:07:58	[PI] O1_A2 poor quality
9:18:26	0:08:03	[PI] EOG_L poor quality
9:18:31	0:08:08	[PI] EOG_R poor quality
9:18:36	0:08:13	[PI] O1_A2 poor quality
9:18:41	0:08:18	[PI] EOG_R poor quality
9:18:50	0:08:27	[PI] EOG_L poor quality
9:18:52	0:08:28	[PI] EOG_R poor quality
9:19:02	0:08:39	[PI] O2_A1 poor quality
9:19:15	0:08:47	5:O2_A1 Flat
9:19:26	0:08:58	[PI] O2_A1 poor quality
9:19:36	0:09:05	7:EOG_R
9:19:38	0:09:07	[PI] EOG_R poor quality
9:19:43	0:09:12	[PI] EOG_L poor quality
9:20:08	0:09:36	4:O1_A2 Noise
9:20:10	0:09:37	2:C3_A2 Noise
9:20:26	0:09:52	[PI] O1_A2 poor quality
9:20:26	0:09:52	[PI] O2_A1 poor quality
9:20:52	0:10:16	5:O2_A1 Popping
9:20:52	0:10:16	[PI] O2_A1 poor quality
9:20:55	0:10:18	3:C4_A1 Popping
9:20:55	0:10:18	[PI] O1_A2 poor quality
9:20:57	0:10:20	2:C3_A2 Popping
9:21:01	0:10:21	4:O1_A2 Popping
9:21:09	0:10:28	5:O2_A1 Flat
9:21:21	0:10:39	[PI] O1_A2 poor quality
9:21:22	0:10:40	[PI] O2_A1 poor quality
9:21:26	0:10:44	[PI] EOG_L poor quality
9:21:26	0:10:44	[PI] EOG_R poor quality
9:21:38	0:10:50	5:O2_A1 Other: other
9:21:43	0:10:54	5:O2_A1 Popping
9:21:50	0:10:55	3:C4_A1
9:22:21	0:11:25	4:O1_A2 Noise
9:22:24	0:11:26	2:C3_A2 Noise

```
9:22:30  0:11:32  [ PI]  O1_A2 poor quality
9:22:34  0:11:34  3:C4_A1
9:23:05  0:12:04  [ PI]  O1_A2 poor quality
9:23:05  0:12:04  [ PI]  O2_A1 poor quality
9:23:10  0:12:09  [ PI]  EOG_L poor quality
9:23:14  0:12:13  [ PI]  EOG_R poor quality
9:23:25  0:12:23  4:O1_A2   Noise
9:23:28  0:12:24  2:C3_A2   Noise
9:23:46  0:12:42  [ PI]  O2_A1 poor quality
9:23:55  0:12:45  5:O2_A1   Other: saturate
9:24:25  0:13:15  [ PI]  O1_A2 poor quality
9:24:25  0:13:15  [ PI]  O2_A1 poor quality
9:24:31  0:13:19  2:C3_A2   Popping
9:24:31  0:13:19  [ PI]  C4_A1 poor quality
9:24:34  0:13:20  3:C4_A1   Popping
9:24:34  0:13:20  [ PI]  EOG_R poor quality
9:24:37  0:13:21  5:O2_A1   Popping
9:24:52  0:13:36  [ PI]  O2_A1 poor quality
9:24:58  0:13:42  [ PI]  O1_A2 poor quality
9:25:06  0:13:50  [ PI]  EOG_R poor quality
9:25:10  0:13:54  [ PI]  O1_A2 poor quality
9:25:18  0:13:58  4:O1_A2   Popping
9:25:34  0:14:06  4:O1_A2   Other: other
9:25:52  0:14:20  5:O2_A1
9:25:58  0:14:25  [ PI]  O2_A1 poor quality
9:26:15  0:14:39  4:O1_A2   Other: other
9:26:21  0:14:44  5:O2_A1   Popping
9:26:24  0:14:45  3:C4_A1   Popping
9:26:26  0:14:46  2:C3_A2   Popping
9:26:33  0:14:50  5:O2_A1   Popping
9:26:35  0:14:51  2:C3_A2   Popping
9:26:37  0:14:52  3:C4_A1   Popping
9:26:46  0:15:00  5:O2_A1
9:27:04  0:15:18  [ PI]  O1_A2 poor quality
9:27:06  0:15:20  [ PI]  O2_A1 poor quality
9:27:09  0:15:21  5:O2_A1   Popping
9:27:11  0:15:22  3:C4_A1   Popping
9:27:11  0:15:22  [ PI]  C3_A2 poor quality
9:27:13  0:15:23  2:C3_A2   Popping
9:27:13  0:15:23  [ PI]  C4_A1 poor quality
9:27:15  0:15:24  4:O1_A2   Popping
```

sub08111.txt

```
Data file used:   C:/PI/DATAFILE/RICK_6~1.VPD
9:13:34  0:00:19  [ PI]  O1_A2 poor quality
9:13:34  0:00:19  [ PI]  C4_A1 poor quality
9:13:34  0:00:19  [ PI]  O2_A1 poor quality
9:13:38  0:00:20  4:O1_A2   Popping
9:13:57  0:00:31  4:O1_A2
9:14:00  0:00:34  [ PI]  O2_A1 poor quality
9:14:01  0:00:35  [ PI]  EKG poor quality
9:14:10  0:00:40  5:O2_A1   Popping
9:14:25  0:00:52  4:O1_A2   Flat
9:14:46  0:01:12  [ PI]  O1_A2 poor quality
9:14:46  0:01:13  [ PI]  EKG poor quality
9:14:51  0:01:15  EKG   Noise
9:14:53  0:01:17  [ PI]  O2_A1 poor quality
9:14:59  0:01:21  5:O2_A1   Popping
9:15:10  0:01:26  5:O2_A1   Flat
9:15:14  0:01:28  4:O1_A2   Popping
9:15:22  0:01:36  [ PI]  O2_A1 poor quality
9:15:23  0:01:37  [ PI]  O1_A2 poor quality
9:15:29  0:01:39  5:O2_A1   Flat
9:15:32  0:01:41  4:O1_A2   Popping
9:15:45  0:01:54  [ PI]  O1_A2 poor quality
9:15:49  0:01:55  4:O1_A2   Popping
9:15:52  0:01:58  [ PI]  O2_A1 poor quality
9:15:54  0:01:59  EKG   Noise
9:15:58  0:02:01  5:O2_A1   Popping
```

```
9:16:03  0:02:03  4:O1_A2
9:16:08  0:02:05  5:O2_A1   Poppıng
9:16:11  0:02:08  [ PI]  O1_A2 poor quality
9:16:14  0:02:10  4:O1_A2   Popping
9:16:23  0:02:16  5:O2_A1   Popping
9:16:28  0:02:18  4:O1_A2   Popping
9:16:42  0:02:27  4:O1_A2   Popping
9:16:47  0:02:30  5:O2_A1   Popping
9:16:53  0:02:34  EKG   Noise
9:16:53  0:02:34  [ PI]  EKG poor quality
9:16:54  0:02:34  [ PI]  O2_A1 poor quality
9:16:58  0:02:36  5:O2_A1   Popping
9:17:02  0:02:38  3:C4_A1   Popping
9:17:04  0:02:40  4:O1_A2   Popping
9:17:07  0:02:41  2:C3_A2   Popping
9:17:14  0:02:46  EKG   Noise
9:17:18  0:02:48  5:O2_A1   Popping
9:17:22  0:02:50  4:O1_A2   Popping
9:17:28  0:02:53  4:O1_A2   Flat
9:17:35  0:02:57  EKG
9:17:39  0:03:00  [ PI]  O2_A1 poor quality
9:17:43  0:03:03  5:O2_A1   Poppıng
9:17:49  0:03:05  4:O1_A2   Poppıng
9:18:02  0:03:15  4:O1_A2   Flat
9:18:14  0:03:23  5:O2_A1   Popping
9:18:16  0:03:25  [ PI]  EKG poor quality
9:18:19  0:03:26  4:O1_A2   Flat
9:18:23  0:03:28  EKG   Noise
9:18:25  0:03:30  [ PI]  O2_A1 poor quality
9:18:30  0:03:32  5:O2_A1   Popping
9:18:30  0:03:32  [ PI]  C4_A1 poor quality
9:18:33  0:03:34  4:O1_A2   Popping
9:18:41  0:03:39  5:O2_A1   Popping
9:18:42  0:03:40  [ PI]  C3_A2 poor quality
9:18:48  0:03:44  4:O1_A2   Flat
9:18:59  0:03:47  2:C3_A2
9:19:02  0:03:50  [ PI]  O2_A1 poor qualıty
9:19:07  0:03:54  4:O1_A2   Popping
9:19:13  0:03:58  2:C3_A2   Popping
9:19:17  0:04:01  5:O2_A1   Popping
9:19:22  0:04:06  [ PI]  O2_A1 poor quality
9:19:25  0:04:07  4:O1_A2   Popping
9:19:39  0:04:18  5:O2_A1
9:19:55  0:04:33  [ PI]  O1_A2 poor quality
9:20:04  0:04:34  4:O1_A2   Flat
9:20:04  0:04:34  [ PI]  O2_A1 poor qualıty
9:20:10  0:04:38  5:O2_A1   Popping
9:20:22  0:04:49  EKG   Noise
9:20:28  0:04:54  [ PI]  O2_A1 poor quality
9:20:31  0:04:55  4:O1_A2   Poppıng
9:20:41  0:05:05  [ PI]  EKG poor quality
9:20:50  0:05:14  [ PI]  O2_A1 poor qualıty
9:20:54  0:05:16  5:O2_A1   Popping
9:20:56  0:05:18  3:C4_A1   Poppıng
9:21:03  0:05:20  4:O1_A2   Popping
9:21:08  0:05:23  5:O2_A1   Popping
9:21:09  0:05:24  [ PI]  C4_A1 poor quality
9:21:10  0:05:25  [ PI]  C3_A2 poor quality
9:21:13  0:05:26  3:C4_A1   Popping
9:21:16  0:05:27  2:C3_A2   Popping
9:21:28  0:05:38  5:O2_A1   Poppıng
9:21:32  0:05:40  3:C4_A1   Popping
9:21:51  0:05:53  4:O1_A2   Flat
9:22:22  0:06:20  4:O1_A2   Flat
9:22:45  0:06:41  EKG   Noıse
9:22:48  0:06:43  [ PI]  O1_A2 poor quality
9:22:56  0:06:45  4:O1_A2   Flat
9:23:09  0:06:58  [ PI]  C3_A2 poor quality
9:23:13  0:07:00  2:C3_A2   Popping
9:23:16  0:07:02  [ PI]  EOG_L poor quality
9:23:19  0:07:03  3:C4_A1   Popping
```

```
9:23:24  0:07:04  6:EOG_L   Flat
9:23:30  0:07:07  7:EOG_R   Popping
9:23:37  0:07:14  [PI]  O1_A2 poor quality
9:23:40  0:07:15  4:O1_A2   Popping
9:23:56  0:07:29  EKG   Noise
9:23:56  0:07:29  [PI]  O1_A2 poor quality
9:23:57  0:07:30  [PI]  O2_A1 poor quality
9:24:03  0:07:32  5:O2_A1   Popping
9:24:10  0:07:34  4:O1_A2   Popping
9:24:15  0:07:37  2:C3_A2   Popping
9:24:19  0:07:39  3:C4_A1   Popping
9:24:31  0:07:49  5:O2_A1   Flat
9:24:41  0:07:58  [PI]  O1_A2 poor quality
9:24:46  0:08:03  [PI]  EOG_L poor quality
9:24:50  0:08:04  4:O1_A2   Flat
9:24:55  0:08:08  [PI]  EOG_R poor quality
9:25:00  0:08:13  [PI]  O1_A2 poor quality
9:25:04  0:08:18  [PI]  EOG_R poor quality
9:25:13  0:08:23  7:EOG_R   Flat
9:25:21  0:08:26  4:O1_A2   Flat
9:25:21  0:08:27  [PI]  EOG_L poor quality
9:25:23  0:08:28  [PI]  EOG_R poor quality
9:25:29  0:08:32  6:EOG_L   Flat
9:25:37  0:08:39  5:O2_A1   Popping
9:25:38  0:08:39  [PI]  O2_A1 poor quality
9:25:43  0:08:43  5:O2_A1   Flat
9:25:47  0:08:45  4:O1_A2   Popping
9:26:00  0:08:58  [PI]  O2_A1 poor quality
9:26:09  0:09:07  [PI]  EOG_R poor quality
9:26:12  0:09:09  7:EOG_R   Flat
9:26:15  0:09:12  [PI]  EOG_L poor quality
9:26:55  0:09:52  [PI]  O1_A2 poor quality
9:26:55  0:09:52  [PI]  O2_A1 poor quality
9:26:58  0:09:53  4:O1_A2   Popping
9:27:01  0:09:54  5:O2_A1   Flat
9:27:25  0:10:16  5:O2_A1   Popping
9:27:25  0:10:16  [PI]  O2_A1 poor quality
9:27:27  0:10:18  2:C3_A2   Popping
9:27:28  0:10:18  [PI]  O1_A2 poor quality
9:27:30  0:10:19  4:O1_A2   Popping
9:27:33  0:10:20  3:C4_A1   Popping
9:27:48  0:10:34  5:O2_A1   Flat
9:27:53  0:10:39  [PI]  O1_A2 poor quality
9:27:54  0:10:40  [PI]  O2_A1 poor quality
9:27:59  0:10:43  5:O2_A1   Popping
9:27:59  0:10:44  [PI]  EOG_L poor quality
9:27:59  0:10:44  [PI]  EOG_R poor quality
9:28:02  0:10:45  4:O1_A2   Popping
9:28:10  0:10:52  5:O2_A1   Flat
9:28:24  0:11:04  4:O1_A2   Flat
9:28:52  0:11:32  [PI]  O1_A2 poor quality
9:28:56  0:11:33  5:O2_A1   Popping
9:29:03  0:11:35  4:O1_A2   Popping
9:29:32  0:12:04  [PI]  O1_A2 poor quality
9:29:32  0:12:04  [PI]  O2_A1 poor quality
9:29:35  0:12:05  5:O2_A1   Popping
9:29:38  0:12:06  4:O1_A2   Flat
9:29:42  0:12:08  5:O2_A1   Popping
9:29:43  0:12:09  [PI]  EOG_L poor quality
9:29:51  0:12:10  3:C4_A1
9:29:55  0:12:13  [PI]  EOG_R poor quality
9:30:24  0:12:42  [PI]  O2_A1 poor quality
9:30:29  0:12:44  5:O2_A1   Flat
9:31:01  0:13:15  [PI]  O1_A2 poor quality
9:31:01  0:13:15  [PI]  O2_A1 poor quality
9:31:04  0:13:17  5:O2_A1   Flat
9:31:07  0:13:18  4:O1_A2   Popping
9:31:09  0:13:19  3:C4_A1   Popping
9:31:10  0:13:19  [PI]  C4_A1 poor quality
9:31:12  0:13:20  2:C3_A2   Popping
9:31:12  0:13:20  [PI]  EOG_R poor quality
```

```
9:31:28  0:13:36  [PI]  O2_A1 poor quality
9:31:32  0:13:37  5:O2_A1   Flat
9:31:39  0:13:40  4:O1_A2   Popping
9:31:41  0:13:42  [PI]  O1_A2 poor quality
9:31:45  0:13:43  5:O2_A1   Popping
9:31:48  0:13:45  4:O1_A2
9:31:54  0:13:50  [PI]  EOG_R poor quality
9:31:58  0:13:54  [PI]  O1_A2 poor quality
9:32:00  0:13:55  4:O1_A2   Popping
9:32:05  0:13:58  5:O2_A1   Popping
9:32:17  0:14:09  3:C4_A1   Popping
9:32:19  0:14:10  2:C3_A2   Popping
9:32:22  0:14:12  5:O2_A1   Popping
9:32:36  0:14:25  [PI]  O2_A1 poor quality
9:32:45  0:14:32  5:O2_A1   Popping
9:32:54  0:14:33  2:C3_A2   Popping
9:32:57  0:14:36  4:O1_A2   Popping
9:33:01  0:14:38  5:O2_A1   Popping
9:33:42  0:15:17  5:O2_A1   Popping
9:33:43  0:15:18  [PI]  O1_A2 poor quality
9:33:46  0:15:20  2:C3_A2   Popping
9:33:46  0:15:20  [PI]  O2_A1 poor quality
9:33:51  0:15:22  4:O1_A2   Flat
9:33:52  0:15:22  [PI]  C3_A2 poor quality
9:33:52  0:15:23  [PI]  C4_A1 poor quality
9:33:54  0:15:24  3:C4_A1   Popping
9:33:59  0:15:26  EKG   Noise
```

sub08120.txt

```
9:08:41  0:00:03  4:O1_A2   Popping
9:08:46  0:00:05  5:O2_A1   Popping
9:08:52  0:00:06  EKG   Flat
9:08:55  0:00:09  3:C4_A1   Popping
9:08:58  0:00:11  2:C3_A2   Popping
9:09:06  0:00:19  [PI]  O1_A2 poor quality
9:09:06  0:00:19  [PI]  C4_A1 poor quality
9:09:06  0:00:19  [PI]  O2_A1 poor quality
9:09:15  0:00:24  4:O1_A2   Popping
9:09:26  0:00:33  EKG   Noise
9:09:27  0:00:34  [PI]  O2_A1 poor quality
9:09:30  0:00:35  4:O1_A2   Popping
9:09:30  0:00:35  [PI]  EKG poor quality
9:09:32  0:00:37  2:C3_A2   Popping
9:09:35  0:00:38  3:C4_A1   Popping
9:09:38  0:00:40  5:O2_A1   Popping
9:09:46  0:00:47  4:O1_A2   Flat
9:10:08  0:01:01  5:O2_A1
9:10:15  0:01:05  4:O1_A2   Popping
9:10:19  0:01:07  EKG   Noise
9:10:24  0:01:12  [PI]  O1_A2 poor quality
9:10:26  0:01:13  5:O2_A1   Popping
9:10:26  0:01:13  [PI]  EKG poor quality
9:10:29  0:01:14  2:C3_A2   Popping
9:10:32  0:01:16  3:C4_A1   Popping
9:10:33  0:01:17  [PI]  O2_A1 poor quality
9:10:44  0:01:24  4:O1_A2   Popping
9:10:48  0:01:26  5:O2_A1   Popping
9:10:57  0:01:36  [PI]  O2_A1 poor quality
9:10:58  0:01:37  [PI]  O1_A2 poor quality
9:11:02  0:01:38  5:O2_A1   Flat
9:11:05  0:01:40  4:O1_A2   Popping
9:11:19  0:01:54  [PI]  O1_A2 poor quality
9:11:22  0:01:55  4:O1_A2   Popping
9:11:25  0:01:57  5:O2_A1   Popping
9:11:29  0:01:58  3:C4_A1   Popping
9:11:29  0:01:58  [PI]  O2_A1 poor quality
9:11:38  0:02:07  4:O1_A2   Popping
9:11:40  0:02:08  [PI]  O1_A2 poor quality
9:11:44  0:02:10  5:O2_A1   Popping
```

```
9:11:46  0:02:11  3:C4_A1   Popping
9:11:51  0:02:14  2:C3_A2   Popping
9:11:58  0:02:18  7:EOG_R   Popping
9:12:01  0:02:21  6:EOG_L
9:12:09  0:02:27  4:O1_A2   Popping
9:12:12  0:02:28  3:C4_A1   Popping
9:12:15  0:02:30  5:O2_A1   Popping
9:12:19  0:02:34  [PI]  EKG poor quality
9:12:19  0:02:34  [PI]  O2_A1 poor quality
9:12:22  0:02:36  5:O2_A1   Popping
9:12:25  0:02:38  2:C3_A2   Popping
9:12:29  0:02:41  EKG   Noise
9:12:48  0:03:00  [PI]  O2_A1 poor quality
9:12:52  0:03:02  5:O2_A1   Popping
9:12:55  0:03:03  2:C3_A2   Popping
9:12:59  0:03:05  4:O1_A2   Popping
9:13:01  0:03:07  3:C4_A1   Popping
9:13:16  0:03:09  7:EOG_R
9:13:29  0:03:17  4:O1_A2   Popping
9:13:33  0:03:18  2:C3_A2
9:13:35  0:03:20  5:O2_A1   Popping
9:13:40  0:03:23  3:C4_A1   Popping
9:13:43  0:03:24  EKG   Noise
9:13:43  0:03:25  [PI]  EKG poor quality
9:13:47  0:03:26  2:C3_A2   Popping
9:13:51  0:03:30  [PI]  O2_A1 poor quality
9:13:53  0:03:32  [PI]  C4_A1 poor quality
9:13:58  0:03:35  4:O1_A2   Popping
9:14:02  0:03:39  2:C3_A2   Popping
9:14:05  0:03:40  5:O2_A1   Popping
9:14:05  0:03:40  [PI]  C3_A2 poor quality
9:14:16  0:03:45  6:EOG_L   Flat
9:14:22  0:03:50  [PI]  O2_A1 poor quality
9:14:28  0:03:54  2:C3_A2   Popping
9:14:31  0:03:56  3:C4_A1   Popping
9:14:34  0:03:58  5:O2_A1   Popping
9:14:38  0:04:00  4:O1_A2   Popping
9:14:43  0:04:06  [PI]  O2_A1 poor quality
9:14:46  0:04:07  4:O1_A2   Flat
9:14:50  0:04:10  3:C4_A1   Popping
9:14:53  0:04:11  2:C3_A2   Popping
9:14:56  0:04:13  5:O2_A1   Popping
9:15:16  0:04:33  [PI]  O1_A2 poor quality
9:15:17  0:04:34  [PI]  O2_A1 poor quality
9:15:20  0:04:35  3:C4_A1   Popping
9:15:22  0:04:36  5:O2_A1   Popping
9:15:26  0:04:37  4:O1_A2   Flat
9:15:36  0:04:45  3:C4_A1   Popping
9:15:42  0:04:49  5:O2_A1   Popping
9:15:48  0:04:54  EKG
9:15:48  0:04:54  [PI]  O2_A1 poor quality
9:15:53  0:04:58  5:O2_A1   Popping
9:15:56  0:04:59  4:O1_A2   Popping
9:16:02  0:05:05  [PI]  EKG poor quality
9:16:06  0:05:08  EKG   Noise
9:16:10  0:05:09  4:O1_A2   Popping
9:16:12  0:05:10  5:O2_A1   Popping
9:16:16  0:05:12  3:C4_A1   Popping
9:16:19  0:05:14  [PI]  O2_A1 poor quality
9:16:22  0:05:15  2:C3_A2   Popping
9:16:25  0:05:16  4:O1_A2   Popping
9:16:27  0:05:18  5:O2_A1   Popping
9:16:34  0:05:23  EKG   Noise
9:16:35  0:05:24  [PI]  C4_A1 poor quality
9:16:38  0:05:25  4:O1_A2   Popping
9:16:38  0:05:25  [PI]  C3_A2 poor quality
9:16:40  0:05:27  2:C3_A2   Popping
9:16:43  0:05:28  3:C4_A1   Popping
9:16:46  0:05:29  5:O2_A1   Popping
9:16:54  0:05:36  4:O1_A2   Flat
9:16:57  0:05:38  3:C4_A1   Popping
```

```
9:17:00  0:05:39  5:O2_A1   Popping
9:17:11  0:05:47  4:O1_A2   Flat
9:17:22  0:05:55  4:O1_A2   Popping
9:17:38  0:06:09  4:O1_A2   Popping
9:17:48  0:06:15  EKG   Noise
9:17:53  0:06:18  4:O1_A2   Popping
9:18:04  0:06:27  4:O1_A2   Flat
9:18:20  0:06:40  EKG   Noise
9:18:22  0:06:43  [ PI]  O1_A2 poor quality
9:18:27  0:06:45  5:O2_A1   Popping
9:18:30  0:06:47  4:O1_A2   Popping
9:18:41  0:06:58  [ PI]  C3_A2 poor quality
9:18:43  0:06:59  2:C3_A2   Popping
9:18:46  0:07:01  3:C4_A1   Popping
9:18:47  0:07:02  [ PI]  EOG_L poor quality
9:18:52  0:07:05  6:EOG_L   Popping
9:18:55  0:07:06  7:EOG_R   Popping
9:18:59  0:07:09  2:C3_A2   Popping
9:19:04  0:07:14  [ PI]  O1_A2 poor quality
9:19:07  0:07:15  4:O1_A2   Popping
9:19:21  0:07:29  [ PI]  O1_A2 poor quality
9:19:23  0:07:30  2:C3_A2   Popping
9:19:23  0:07:30  [ PI]  O2_A1 poor quality
9:19:26  0:07:32  4:O1_A2   Popping
9:19:28  0:07:33  3:C4_A1   Popping
9:19:31  0:07:35  5:O2_A1   Popping
9:19:47  0:07:37  EKG   Other: Irr. shape
9:19:51  0:07:40  5:O2_A1   Flat
9:20:00  0:07:47  4:O1_A2   Popping
9:20:05  0:07:48  5:O2_A1   Popping
9:20:15  0:07:58  [ PI]  O1_A2 poor quality
9:20:19  0:08:00  4:O1_A2   Popping
9:20:22  0:08:03  [ PI]  EOG_L poor quality
9:20:28  0:08:04  6:EOG_L   Flat
9:20:31  0:08:06  4:O1_A2   Popping
9:20:33  0:08:08  [ PI]  EOG_R poor quality
9:20:38  0:08:13  [ PI]  O1_A2 poor quality
9:20:43  0:08:18  [ PI]  EOG_R poor quality
9:20:45  0:08:19  4:O1_A2   Flat
9:20:54  0:08:25  4:O1_A2   Flat
9:20:58  0:08:27  6:EOG_L   Flat
9:20:58  0:08:27  [ PI]  EOG_L poor quality
9:20:58  0:08:28  [ PI]  EOG_R poor quality
9:21:01  0:08:29  4:O1_A2   Flat
9:21:07  0:08:33  7:EOG_R   Flat
9:21:13  0:08:37  6:EOG_L   Flat
9:21:14  0:08:39  [ PI]  O2_A1 poor quality
9:21:17  0:08:40  4:O1_A2   Popping
9:21:20  0:08:42  5:O2_A1   Popping
9:21:24  0:08:44  3:C4_A1   Popping
9:21:28  0:08:47  5:O2_A1   Flat
9:21:39  0:08:58  [ PI]  O2_A1 poor quality
9:21:42  0:09:00  5:O2_A1   Flat
9:21:46  0:09:02  7:EOG_R   Popping
9:21:53  0:09:06  2:C3_A2
9:21:54  0:09:07  [ PI]  EOG_R poor quality
9:21:59  0:09:10  6:EOG_L   Flat
9:22:02  0:09:11  7:EOG_R   Flat
9:22:03  0:09:12  [ PI]  EOG_L poor quality
9:22:43  0:09:52  [ PI]  O1_A2 poor quality
9:22:43  0:09:52  [ PI]  O2_A1 poor quality
9:22:45  0:09:53  4:O1_A2   Popping
9:22:50  0:09:55  5:O2_A1   Flat
9:23:12  0:10:16  5:O2_A1   Popping
9:23:12  0:10:16  [ PI]  O2_A1 poor quality
9:23:14  0:10:17  3:C4_A1   Popping
9:23:17  0:10:18  2:C3_A2   Popping
9:23:17  0:10:18  [ PI]  O1_A2 poor quality
9:23:19  0:10:19  4:O1_A2   Popping
9:23:28  0:10:27  5:O2_A1   Flat
9:23:40  0:10:39  [ PI]  O1_A2 poor quality
```

```
9:23:41  0:10:40  [ PI]  O2_A1 poor quality
9:23:45  0:10:43  4:O1_A2   Popping
9:23:47  0:10:44  [ PI]  EOG_L poor quality
9:23:47  0:10:44  [ PI]  EOG_R poor quality
9:23:48  0:10:45  3:C4_A1   Popping
9:23:52  0:10:47  5:O2_A1   Flat
9:23:59  0:10:53  2:C3_A2   Popping
9:24:03  0:10:55  5:O2_A1   Popping
9:24:06  0:10:56  3:C4_A1   Popping
9:24:08  0:10:57  4:O1_A2   Popping
9:24:14  0:11:01  EKG
9:24:23  0:11:08  EKG   Noise
9:24:26  0:11:09  4:O1_A2   Flat
9:24:49  0:11:32  [ PI]  O1_A2 poor quality
9:24:51  0:11:33  2:C3_A2   Popping
9:24:53  0:11:34  3:C4_A1   Popping
9:24:56  0:11:35  4:O1_A2   Popping
9:25:01  0:11:37  5:O2_A1   Popping
9:25:28  0:12:04  [ PI]  O1_A2 poor quality
9:25:28  0:12:04  [ PI]  O2_A1 poor quality
9:25:30  0:12:05  5:O2_A1   Popping
9:25:33  0:12:06  4:O1_A2   Popping
9:25:36  0:12:08  3:C4_A1   Popping
9:25:38  0:12:09  [ PI]  EOG_L poor quality
9:25:42  0:12:13  [ PI]  EOG_R poor quality
9:25:57  0:12:26  5:O2_A1   Popping
9:26:13  0:12:42  [ PI]  O2_A1 poor quality
9:26:18  0:12:44  3:C4_A1
9:26:21  0:12:45  5:O2_A1   Flat
9:26:52  0:13:15  [ PI]  O1_A2 poor quality
9:26:52  0:13:15  [ PI]  O2_A1 poor quality
9:26:56  0:13:17  5:O2_A1   Flat
9:26:58  0:13:19  4:O1_A2   Popping
9:26:59  0:13:19  [ PI]  C4_A1 poor quality
9:27:01  0:13:20  2:C3_A2   Popping
9:27:01  0:13:20  [ PI]  EOG_R poor quality
9:27:04  0:13:21  3:C4_A1   Popping
9:27:10  0:13:26  EKG   Noise
9:27:20  0:13:36  [ PI]  O2_A1 poor quality
9:27:22  0:13:37  5:O2_A1   Popping
9:27:26  0:13:39  4:O1_A2   Popping
9:27:28  0:13:40  2:C3_A2
9:27:31  0:13:42  [ PI]  O1_A2 poor quality
9:27:35  0:13:44  3:C4_A1   Popping
9:27:41  0:13:50  [ PI]  EOG_R poor quality
9:27:45  0:13:54  [ PI]  O1_A2 poor quality
9:27:47  0:13:55  EKG   Noise
9:27:51  0:13:57  4:O1_A2   Popping
9:27:53  0:13:58  2:C3_A2   Popping
9:27:56  0:14:00  3:C4_A1   Popping
9:27:58  0:14:01  5:O2_A1   Popping
9:28:03  0:14:04  4:O1_A2   Popping
9:28:08  0:14:09  5:O2_A1   Popping
9:28:11  0:14:10  3:C4_A1   Popping
9:28:26  0:14:16  4:O1_A2   Flat
9:28:31  0:14:20  2:C3_A2   Popping
9:28:33  0:14:21  3:C4_A1   Popping
9:28:36  0:14:22  5:O2_A1   Popping
9:28:43  0:14:25  5:O2_A1
9:28:43  0:14:25  [ PI]  O2_A1 poor quality
9:28:48  0:14:28  EKG
9:28:51  0:14:29  4:O1_A2   Popping
9:28:55  0:14:32  3:C4_A1   Popping
9:28:59  0:14:35  2:C3_A2   Popping
9:29:03  0:14:36  5:O2_A1   Popping
9:29:10  0:14:42  4:O1_A2   Popping
9:29:13  0:14:44  2:C3_A2   Popping
9:29:15  0:14:45  3:C4_A1   Popping
9:29:20  0:14:47  5:O2_A1   Popping
9:29:27  0:14:52  5:O2_A1   Popping
9:29:30  0:14:54  3:C4_A1
```

```
9:29:33  0:14:56  2:C3_A2   Popping
9:29:39  0:15:00  EKG   Noise
9:29:43  0:15:04  5:O2_A1   Popping
9:29:57  0:15:16  5:O2_A1   Popping
9:29:59  0:15:18  [ PI]  O1_A2 poor quality
9:30:01  0:15:19  2:C3_A2   Popping
9:30:04  0:15:20  4:O1_A2   Popping
9:30:04  0:15:20  [ PI]  O2_A1 poor quality
9:30:05  0:15:22  [ PI]  C3_A2 poor quality
9:30:08  0:15:23  EKG   Noise
9:30:09  0:15:23  [ PI]  C4_A1 poor quality
9:30:12  0:15:25  4:O1_A2   Popping
9:30:14  0:15:26  2:C3_A2   Popping
9:30:18  0:15:26  3:C4_A1   Popping
9:30:21  0:15:26  5:O2_A1   Popping
```

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```
13:15:43  0:00:19  4:O1_A2   Popping
13:15:43  0:00:19  [ PI]  O1_A2 poor quality
13:15:43  0:00:19  [ PI]  C4_A1 poor quality
13:15:43  0:00:19  [ PI]  O2_A1 poor quality
13:15:58  0:00:34  [ PI]  O2_A1 poor quality
13:15:59  0:00:35  [ PI]  EKG poor quality
13:16:03  0:00:37  5:O2_A1   Popping
13:16:39  0:01:12  [ PI]  O1_A2 poor quality
13:16:40  0:01:13  [ PI]  EKG poor quality
13:16:44  0:01:17  [ PI]  O2_A1 poor quality
13:16:52  0:01:23  2:C3_A2   Noise
13:16:59  0:01:28  4:O1_A2   Popping
13:17:07  0:01:36  [ PI]  O2_A1 poor quality
13:17:08  0:01:37  [ PI]  O1_A2 poor quality
13:17:25  0:01:54  [ PI]  O1_A2 poor quality
13:17:29  0:01:58  [ PI]  O2_A1 poor quality
13:17:32  0:01:59  4:O1_A2   Popping
13:17:36  0:02:02  5:O2_A1   Popping
13:17:41  0:02:08  [ PI]  O1_A2 poor quality
13:17:51  0:02:15  5:O2_A1   Popping
13:18:10  0:02:34  [ PI]  EKG poor quality
13:18:10  0:02:34  [ PI]  O2_A1 poor quality
13:18:26  0:02:49  EKG   Noise
13:18:40  0:03:00  4:O1_A2   Popping
13:18:40  0:03:00  [ PI]  O2_A1 poor quality
13:19:04  0:03:23  5:O2_A1   Popping
13:19:06  0:03:25  [ PI]  EKG poor quality
13:19:11  0:03:30  [ PI]  O2_A1 poor quality
13:19:13  0:03:32  [ PI]  C4_A1 poor quality
13:19:21  0:03:40  [ PI]  C3_A2 poor quality
13:19:28  0:03:45  4:O1_A2   Flat
13:19:33  0:03:50  [ PI]  O2_A1 poor quality
13:19:45  0:04:00  4:O1_A2   Flat
13:19:51  0:04:06  [ PI]  O2_A1 poor quality
13:19:58  0:04:10  2:C3_A2   Popping
13:20:02  0:04:13  5:O2_A1   Popping
13:20:21  0:04:33  [ PI]  O1_A2 poor quality
13:20:22  0:04:34  [ PI]  O2_A1 poor quality
13:20:28  0:04:38  5:O2_A1   Popping
13:20:30  0:04:39  4:O1_A2   Flat
13:20:47  0:04:54  4:O1_A2   Popping
13:20:48  0:04:54  [ PI]  O2_A1 poor quality
13:20:59  0:05:05  [ PI]  EKG poor quality
13:21:09  0:05:14  5:O2_A1   Popping
13:21:09  0:05:14  [ PI]  O2_A1 poor quality
13:21:13  0:05:16  3:C4_A1   Popping
13:21:22  0:05:24  4:O1_A2   Popping
13:21:22  0:05:24  [ PI]  C4_A1 poor quality
13:21:23  0:05:25  [ PI]  C3_A2 poor quality
13:21:37  0:05:38  3:C4_A1   Popping
13:21:40  0:05:40  5:O2_A1   Popping
13:21:52  0:05:50  4:O1_A2   Flat
```

```
13:22:45  0:06:43  [PI]  O1_A2 poor quality
13:23:00  0:06:58  [PI]  C3_A2 poor quality
13:23:03  0:06:59  2:C3_A2   Popping
13:23:06  0:07:02  [PI]  EOG_L poor quality
13:23:08  0:07:03  2:C3_A2   Popping
13:23:20  0:07:14  [PI]  O1_A2 poor quality
13:23:29  0:07:22  4:O1_A2   Popping
13:23:35  0:07:26  4:O1_A2   Noise
13:23:38  0:07:27  2:C3_A2   Noise
13:23:39  0:07:29  [PI]  O1_A2 poor quality
13:23:40  0:07:30  [PI]  O2_A1 poor quality
13:23:47  0:07:35  5:O2_A1   Popping
13:23:53  0:07:39  4:O1_A2   Popping
13:24:12  0:07:58  [PI]  O1_A2 poor quality
13:24:17  0:08:03  [PI]  EOG_L poor quality
13:24:22  0:08:08  [PI]  EOG_R poor quality
13:24:26  0:08:11  4:O1_A2   Popping
13:24:28  0:08:13  [PI]  O1_A2 poor quality
13:24:33  0:08:18  [PI]  EOG_R poor quality
13:24:40  0:08:23  4:O1_A2   Flat
13:24:44  0:08:27  [PI]  EOG_L poor quality
13:24:45  0:08:28  [PI]  EOG_R poor quality
13:24:57  0:08:38  2:C3_A2   Noise
13:24:58  0:08:39  [PI]  O2_A1 poor quality
13:25:01  0:08:41  4:O1_A2   Popping
13:25:09  0:08:47  5:O2_A1   Flat
13:25:20  0:08:58  [PI]  O2_A1 poor quality
13:25:29  0:09:07  [PI]  EOG_R poor quality
13:25:34  0:09:12  [PI]  EOG_L poor quality
13:25:46  0:09:21  10:EMGlsm   Noise
13:26:17  0:09:52  [PI]  O1_A2 poor quality
13:26:17  0:09:52  [PI]  O2_A1 poor quality
13:26:22  0:09:55  4:O1_A2   Popping
13:26:29  0:10:00  5:O2_A1   Flat
13:26:45  0:10:16  [PI]  O2_A1 poor quality
13:26:48  0:10:18  5:O2_A1   Popping
13:26:48  0:10:18  [PI]  O1_A2 poor quality
13:26:59  0:10:27  5:O2_A1   Flat
13:27:11  0:10:39  [PI]  O1_A2 poor quality
13:27:12  0:10:40  [PI]  O2_A1 poor quality
13:27:16  0:10:44  [PI]  EOG_L poor quality
13:27:16  0:10:44  [PI]  EOG_R poor quality
13:27:22  0:10:45  5:O2_A1
13:27:26  0:10:48  5:O2_A1   Flat
13:27:46  0:11:06  4:O1_A2   Flat
13:28:12  0:11:32  [PI]  O1_A2 poor quality
13:28:17  0:11:35  4:O1_A2   Popping
13:28:44  0:11:59  6:EOG_L   Noise
13:28:49  0:12:04  [PI]  O1_A2 poor quality
13:28:49  0:12:04  [PI]  O2_A1 poor quality
13:28:55  0:12:08  5:O2_A1   Popping
13:28:55  0:12:09  [PI]  EOG_L poor quality
13:28:59  0:12:13  [PI]  EOG_R poor quality
13:29:28  0:12:42  [PI]  O2_A1 poor quality
13:29:33  0:12:45  5:O2_A1   Flat
13:30:03  0:13:15  [PI]  O1_A2 poor quality
13:30:03  0:13:15  [PI]  O2_A1 poor quality
13:30:06  0:13:16  2:C3_A2   Noise
13:30:09  0:13:18  4:O1_A2   Flat
13:30:13  0:13:19  5:O2_A1   Flat
13:30:14  0:13:19  [PI]  C4_A1 poor quality
13:30:14  0:13:20  [PI]  EOG_R poor quality
13:30:30  0:13:36  [PI]  O2_A1 poor quality
13:30:36  0:13:40  5:O2_A1   Flat
13:30:39  0:13:42  [PI]  O1_A2 poor quality
13:30:45  0:13:46  4:O1_A2   Popping
13:30:49  0:13:50  [PI]  EOG_R poor quality
13:30:53  0:13:54  [PI]  O1_A2 poor quality
13:31:06  0:14:05  4:O1_A2   Popping
13:31:12  0:14:10  5:O2_A1   Popping
13:31:27  0:14:25  [PI]  O2_A1 poor quality
```

```
13:31:39  0:14:35  5:O2_A1   Popping
13:31:44  0:14:39  4:O1_A2   Popping
13:31:47  0:14:41  2:C3_A2   Popping
13:32:25  0:15:18  [ PI]  O1_A2 poor quality
13:32:27  0:15:20  [ PI]  O2_A1 poor quality
13:32:29  0:15:21  4:O1_A2   Popping
13:32:30  0:15:22  [ PI]  C3_A2 poor quality
13:32:31  0:15:23  [ PI]  C4_A1 poor quality
13:32:33  0:15:24  2:C3_A2   Popping
13:32:35  0:15:26  3:C4_A1   Popping
13:32:39  0:15:26  5:O2_A1   Popping
13:32:49  0:15:26  5:O2_A1   Popping
```

sub09121.txt

```
13:04:39  0:00:19  [ PI]  O1_A2 poor quality
13:04:39  0:00:19  [ PI]  C4_A1 poor quality
13:04:39  0:00:19  [ PI]  O2_A1 poor quality
13:04:44  0:00:22  4:O1_A2   Popping
13:04:48  0:00:24  3:C4_A1   Popping
13:04:52  0:00:26  5:O2_A1   Popping
13:05:00  0:00:34  [ PI]  O2_A1 poor quality
13:05:01  0:00:35  [ PI]  EKG poor quality
13:05:08  0:00:39  EKG   Noise
13:05:17  0:00:46  5:O2_A1   Popping
13:05:29  0:00:50  4:O1_A2   Other: saturation
13:05:51  0:01:12  [ PI]  O1_A2 poor quality
13:05:52  0:01:13  [ PI]  EKG poor quality
13:05:58  0:01:17  EKG   Noise
13:05:58  0:01:17  [ PI]  O2_A1 poor quality
13:06:09  0:01:27  5:O2_A1   Popping
13:06:19  0:01:36  [ PI]  O2_A1 poor quality
13:06:20  0:01:37  [ PI]  O1_A2 poor quality
13:06:37  0:01:54  [ PI]  O1_A2 poor quality
13:06:42  0:01:57  4:O1_A2   Popping
13:06:43  0:01:58  [ PI]  O2_A1 poor quality
13:06:46  0:01:59  5:O2_A1   Popping
13:06:55  0:02:08  [ PI]  O1_A2 poor quality
13:07:06  0:02:17  5:O2_A1   Popping
13:07:21  0:02:29  4:O1_A2   Flat
13:07:26  0:02:34  [ PI]  EKG poor quality
13:07:26  0:02:34  [ PI]  O2_A1 poor quality
13:07:30  0:02:36  5:O2_A1   Popping
13:07:37  0:02:41  3:C4_A1   Popping
13:07:41  0:02:43  2:C3_A2   Popping
13:07:46  0:02:46  EKG   Noise
13:08:00  0:03:00  [ PI]  O2_A1 poor quality
13:08:05  0:03:02  5:O2_A1   Popping
13:08:19  0:03:15  5:O2_A1   Popping
13:08:31  0:03:25  EKG   Noise
13:08:31  0:03:25  [ PI]  EKG poor quality
13:08:36  0:03:30  [ PI]  O2_A1 poor quality
13:08:38  0:03:32  [ PI]  C4_A1 poor quality
13:08:43  0:03:34  5:O2_A1   Popping
13:08:49  0:03:39  3:C4_A1   Popping
13:08:51  0:03:40  [ PI]  C3_A2 poor quality
13:09:01  0:03:50  [ PI]  O2_A1 poor quality
13:09:08  0:03:56  2:C3_A2   Popping
13:09:18  0:04:06  [ PI]  O2_A1 poor quality
13:09:21  0:04:07  5:O2_A1   Popping
13:09:47  0:04:33  [ PI]  O1_A2 poor quality
13:09:48  0:04:34  [ PI]  O2_A1 poor quality
13:09:54  0:04:38  4:O1_A2   Flat
13:10:03  0:04:45  5:O2_A1   Popping
13:10:11  0:04:52  EKG   Noise
13:10:14  0:04:54  [ PI]  O2_A1 poor quality
13:10:27  0:04:56  5:O2_A1   Flat
13:10:37  0:05:05  [ PI]  EKG poor quality
13:10:45  0:05:09  5:O2_A1   Flat
13:10:52  0:05:14  4:O1_A2   Popping
```

```
13:10:52  0:05:14  [ PI]  O2_A1 poor quality
13:10:59  0:05:18  3:C4_A1   Popping
13:11:02  0:05:20  5:O2_A1   Popping
13:11:07  0:05:24  [ PI]  C4_A1 poor quality
13:11:10  0:05:25  2:C3_A2   Popping
13:11:10  0:05:25  [ PI]  C3_A2 poor quality
13:11:31  0:05:44  4:O1_A2   Flat
13:12:30  0:06:43  [ PI]  O1_A2 poor quality
13:12:36  0:06:47  6:EOG_L   Noise
13:12:48  0:06:58  [ PI]  C3_A2 poor quality
13:12:51  0:07:00  2:C3_A2   Popping
13:12:54  0:07:02  [ PI]  EOG_L poor quality
13:12:56  0:07:03  3:C4_A1   Popping
13:13:04  0:07:10  7:EOG_R   Popping
13:13:09  0:07:14  [ PI]  O1_A2 poor quality
13:13:24  0:07:29  [ PI]  O1_A2 poor quality
13:13:25  0:07:30  [ PI]  O2_A1 poor quality
13:13:32  0:07:36  4:O1_A2   Popping
13:13:35  0:07:38  5:O2_A1   Popping
13:13:48  0:07:49  5:O2_A1   Flat
13:13:58  0:07:58  [ PI]  O1_A2 poor quality
13:14:03  0:08:03  [ PI]  EOG_L poor quality
13:14:08  0:08:08  [ PI]  EOG_R poor quality
13:14:13  0:08:10  6:EOG_L   Flat
13:14:16  0:08:13  [ PI]  O1_A2 poor quality
13:14:21  0:08:18  [ PI]  EOG_R poor quality
13:14:30  0:08:27  [ PI]  EOG_L poor quality
13:14:31  0:08:28  [ PI]  EOG_R poor quality
13:14:38  0:08:33  6:EOG_L   Flat
13:14:43  0:08:35  7:EOG_R   Flat
13:14:47  0:08:39  [ PI]  O2_A1 poor quality
13:14:53  0:08:43  5:O2_A1   Flat
13:15:07  0:08:58  [ PI]  O2_A1 poor quality
13:15:16  0:09:07  [ PI]  EOG_R poor quality
13:15:21  0:09:12  [ PI]  EOG_L poor quality
13:16:01  0:09:52  [ PI]  O1_A2 poor quality
13:16:01  0:09:52  [ PI]  O2_A1 poor quality
13:16:07  0:09:55  5:O2_A1   Flat
13:16:15  0:09:57  4:O1_A2   Flat
13:16:33  0:10:16  [ PI]  O2_A1 poor quality
13:16:40  0:10:18  4:O1_A2
13:16:40  0:10:18  [ PI]  O1_A2 poor quality
13:16:43  0:10:21  2:C3_A2   Popping
13:16:46  0:10:22  3:C4_A1   Popping
13:16:49  0:10:24  5:O2_A1   Popping
13:16:56  0:10:29  5:O2_A1   Flat
13:17:06  0:10:39  [ PI]  O1_A2 poor quality
13:17:07  0:10:40  [ PI]  O2_A1 poor quality
13:17:11  0:10:44  [ PI]  EOG_L poor quality
13:17:11  0:10:44  [ PI]  EOG_R poor quality
13:17:15  0:10:47  5:O2_A1   Flat
13:17:21  0:10:51  5:O2_A1   Flat
13:17:26  0:10:53  6:EOG_L   Flat
13:17:38  0:11:04  4:O1_A2   Flat
13:18:07  0:11:32  [ PI]  O1_A2 poor quality
13:18:11  0:11:34  4:O1_A2   Popping
13:18:16  0:11:37  5:O2_A1   Flat
13:18:43  0:12:04  [ PI]  O1_A2 poor quality
13:18:43  0:12:04  [ PI]  O2_A1 poor quality
13:18:47  0:12:06  5:O2_A1   Flat
13:18:51  0:12:09  [ PI]  EOG_L poor quality
13:18:59  0:12:11  4:O1_A2   Flat
13:19:01  0:12:13  [ PI]  EOG_R poor quality
13:19:12  0:12:14  6:EOG_L   Other: no error
13:19:21  0:12:18  7:EOG_R   Other: no error
13:19:45  0:12:42  [ PI]  O2_A1 poor quality
13:19:48  0:12:44  5:O2_A1   Flat
13:20:20  0:13:15  [ PI]  O1_A2 poor quality
13:20:20  0:13:15  [ PI]  O2_A1 poor quality
13:20:24  0:13:17  5:O2_A1   Flat
13:20:27  0:13:19  4:O1_A2   Popping
```

```
13:20:28  0:13:19  [ PI]  C4_A1 poor quality
13:20:29  0:13:20  [ PI]  EOG_R poor quality
13:20:40  0:13:24  7:EOG_R   Other: no error
13:20:46  0:13:29  5:O2_A1   Flat
13:20:54  0:13:36  [ PI]  O2_A1 poor quality
13:21:00  0:13:41  5:O2_A1   Flat
13:21:01  0:13:42  [ PI]  O1_A2 poor quality
13:21:06  0:13:45  4:O1_A2   Popping
13:21:11  0:13:50  [ PI]  EOG_R poor quality
13:21:26  0:13:54  7:EOG_R   Other: no error
13:21:26  0:13:54  [ PI]  O1_A2 poor quality
13:21:30  0:13:57  4:O1_A2   Popping
13:21:55  0:14:13  5:O2_A1   Other: saturation
13:22:00  0:14:17  4:O1_A2   Flat
13:22:08  0:14:25  [ PI]  O2_A1 poor quality
13:22:16  0:14:32  5:O2_A1   Popping
13:22:25  0:14:34  2:C3_A2   Other: saturation
13:22:35  0:14:40  2:C3_A2   Flat
13:22:42  0:14:45  5:O2_A1   Popping
13:22:45  0:14:47  2:C3_A2   Popping
13:22:48  0:14:48  3:C4_A1   Popping
13:23:17  0:15:18  [ PI]  O1_A2 poor quality
13:23:19  0:15:20  [ PI]  O2_A1 poor quality
13:23:22  0:15:22  4:O1_A2   Popping
13:23:23  0:15:22  [ PI]  C3_A2 poor quality
13:23:25  0:15:23  2:C3_A2   Popping
13:23:26  0:15:23  [ PI]  C4_A1 poor quality
13:23:30  0:15:26  3:C4_A1   Popping
13:23:33  0:15:26  5:O2_A1   Popping
13:23:39  0:15:26  EKG   Noise
```

sub10110.txt

```
12:15:28  0:00:19  4:O1_A2   Popping
12:15:28  0:00:19  [ PI]  O1_A2 poor quality
12:15:28  0:00:19  [ PI]  C4_A1 poor quality
12:15:28  0:00:19  [ PI]  O2_A1 poor quality
12:15:33  0:00:21  3:C4_A1   Popping
12:15:38  0:00:22  5:O2_A1   Popping
12:15:49  0:00:34  [ PI]  O2_A1 poor quality
12:15:50  0:00:35  [ PI]  EKG poor quality
12:16:21  0:00:39  4:O1_A2   Popping
12:17:02  0:00:53  4:O1_A2   Other: below the minimum (out of bounds)
12:17:21  0:01:12  [ PI]  O1_A2 poor quality
12:17:22  0:01:13  [ PI]  EKG poor quality
12:17:26  0:01:17  [ PI]  O2_A1 poor quality
12:18:01  0:01:20  5:O2_A1   Other: out of range
12:18:17  0:01:36  [ PI]  O2_A1 poor quality
12:18:18  0:01:37  [ PI]  O1_A2 poor quality
12:18:35  0:01:54  [ PI]  O1_A2 poor quality
12:18:39  0:01:58  [ PI]  O2_A1 poor quality
12:18:48  0:01:59  4:O1_A2   Popping
12:18:51  0:02:01  EKG   Noise
12:18:58  0:02:08  [ PI]  O1_A2 poor quality
12:19:24  0:02:34  [ PI]  EKG poor quality
12:19:24  0:02:34  [ PI]  O2_A1 poor quality
12:19:36  0:02:38  5:O2_A1   Popping
12:19:40  0:02:39  3:C4_A1   Popping
12:19:44  0:02:42  EKG   Noise
12:20:02  0:03:00  [ PI]  O2_A1 poor quality
12:20:14  0:03:10  3:C4_A1   Popping
12:20:29  0:03:25  [ PI]  EKG poor quality
12:20:35  0:03:28  EKG   Noise
12:20:39  0:03:30  2:C3_A2   Noise
12:20:39  0:03:30  [ PI]  O2_A1 poor quality
12:20:41  0:03:32  [ PI]  C4_A1 poor quality
12:20:49  0:03:40  [ PI]  C3_A2 poor quality
12:20:59  0:03:50  [ PI]  O2_A1 poor quality
12:21:32  0:03:55  3:C4_A1   Flat
12:21:44  0:04:02  4:O1_A2   Flat
```

```
12:21:48  0:04:06  [PI]  O2_A1 poor quality
12:21:57  0:04:10  4:O1_A2   Flat
12:22:06  0:04:15  5:O2_A1   Popping
12:22:25  0:04:33  [PI]  O1_A2 poor quality
12:22:26  0:04:34  [PI]  O2_A1 poor quality
12:22:46  0:04:54  [PI]  O2_A1 poor quality
12:22:57  0:05:05  [PI]  EKG poor quality
12:23:07  0:05:11  EKG   Noise
12:23:10  0:05:14  [PI]  O2_A1 poor quality
12:23:16  0:05:18  5:O2_A1   Popping
12:23:23  0:05:21  4:O1_A2   Popping
12:23:26  0:05:24  [PI]  C4_A1 poor quality
12:23:27  0:05:25  [PI]  C3_A2 poor quality
12:24:45  0:06:43  [PI]  O1_A2 poor quality
12:24:54  0:06:49  2:C3_A2   Noise
12:24:57  0:06:51  4:O1_A2   Noise
12:25:04  0:06:58  [PI]  C3_A2 poor quality
12:25:08  0:07:02  [PI]  EOG_L poor quality
12:25:21  0:07:08  2:C3_A2   Popping
12:25:26  0:07:10  7:EOG_R   Popping
12:25:30  0:07:14  [PI]  O1_A2 poor quality
12:25:45  0:07:29  [PI]  O1_A2 poor quality
12:25:46  0:07:30  [PI]  O2_A1 poor quality
12:25:50  0:07:31  EKG   Noise
12:26:09  0:07:44  5:O2_A1   Popping
12:26:12  0:07:45  4:O1_A2   Popping
12:26:26  0:07:58  [PI]  O1_A2 poor quality
12:26:42  0:08:02  6:EOG_L   Flat
12:26:43  0:08:03  [PI]  EOG_L poor quality
12:26:48  0:08:08  [PI]  EOG_R poor quality
12:26:53  0:08:13  [PI]  O1_A2 poor quality
12:26:58  0:08:18  [PI]  EOG_R poor quality
12:27:07  0:08:27  [PI]  EOG_L poor quality
12:27:08  0:08:28  [PI]  EOG_R poor quality
12:27:19  0:08:39  [PI]  O2_A1 poor quality
12:27:40  0:08:52  5:O2_A1   Other: out of bound
12:27:46  0:08:58  [PI]  O2_A1 poor quality
12:27:55  0:09:07  [PI]  EOG_R poor quality
12:28:07  0:09:09  7:EOG_R
12:28:10  0:09:12  [PI]  EOG_L poor quality
12:28:30  0:09:23  10:EMGlsm
12:28:32  0:09:25  11:EMGrsm
12:28:59  0:09:52  [PI]  O1_A2 poor quality
12:28:59  0:09:52  [PI]  O2_A1 poor quality
12:29:09  0:09:59  4:O1_A2   Popping
12:29:25  0:10:16  [PI]  O2_A1 poor quality
12:29:27  0:10:18  [PI]  O1_A2 poor quality
12:29:33  0:10:22  6:EOG_L   Flat
12:29:51  0:10:39  [PI]  O1_A2 poor quality
12:29:52  0:10:40  [PI]  O2_A1 poor quality
12:29:56  0:10:44  [PI]  EOG_L poor quality
12:29:56  0:10:44  [PI]  EOG_R poor quality
12:30:44  0:11:32  [PI]  O1_A2 poor quality
12:30:56  0:11:42  6:EOG_L   Noise
12:31:18  0:12:04  [PI]  O1_A2 poor quality
12:31:18  0:12:04  [PI]  O2_A1 poor quality
12:31:23  0:12:09  [PI]  EOG_L poor quality
12:31:26  0:12:10  4:O1_A2   Popping
12:31:28  0:12:13  [PI]  EOG_R poor quality
12:31:57  0:12:42  [PI]  O2_A1 poor quality
12:32:11  0:12:50  5:O2_A1   Other: out of range
12:32:36  0:13:15  [PI]  O1_A2 poor quality
12:32:36  0:13:15  [PI]  O2_A1 poor quality
12:32:40  0:13:19  [PI]  C4_A1 poor quality
12:32:41  0:13:20  [PI]  EOG_R poor quality
12:32:51  0:13:25  3:C4_A1   Popping
12:32:57  0:13:27  5:O2_A1   Popping
12:33:06  0:13:36  [PI]  O2_A1 poor quality
12:33:12  0:13:42  [PI]  O1_A2 poor quality
12:33:20  0:13:50  [PI]  EOG_R poor quality
12:33:24  0:13:54  [PI]  O1_A2 poor quality
```

```
12:33:36  0:14:04  4:O1_A2   Popping
12:33:57  0:14:25  [PI]  O2_A1 poor quality
12:34:35  0:14:41  5:O2_A1   Other: appears out of range
12:34:46  0:14:48  5:O2_A1   Popping
12:35:16  0:15:18  [PI]  O1_A2 poor quality
12:35:18  0:15:20  [PI]  O2_A1 poor quality
12:35:20  0:15:22  [PI]  C3_A2 poor quality
12:35:21  0:15:23  [PI]  C4_A1 poor quality
12:35:27  0:15:26  5:O2_A1   Popping
12:35:30  0:15:26  3:C4_A1   Popping
12:35:33  0:15:26  2:C3_A2   Popping
12:35:36  0:15:26  4:O1_A2   Popping
```

sub10121.txt

```
12:04:09  0:00:19  [PI]  O1_A2 poor quality
12:04:09  0:00:19  [PI]  C4_A1 poor quality
12:04:09  0:00:19  [PI]  O2_A1 poor quality
12:04:17  0:00:24  4:O1_A2   Popping
12:04:28  0:00:26  5:O2_A1   Popping
12:04:36  0:00:34  [PI]  O2_A1 poor quality
12:04:37  0:00:35  [PI]  EKG poor quality
12:04:42  0:00:37  6:EOG_L   Noise
12:04:46  0:00:38  EKG   Noise
12:04:51  0:00:41  4:O1_A2   Popping
12:04:56  0:00:43  5:O2_A1   Popping
12:05:05  0:00:49  4:O1_A2   Popping
12:05:17  0:00:59  EKG   Noise
12:05:30  0:01:12  [PI]  O1_A2 poor quality
12:05:31  0:01:13  [PI]  EKG poor quality
12:05:35  0:01:15  4:O1_A2   Popping
12:05:39  0:01:16  EKG   Noise
12:05:40  0:01:17  [PI]  O2_A1 poor quality
12:05:46  0:01:21  5:O2_A1   Popping
12:06:02  0:01:35  4:O1_A2
12:06:03  0:01:36  [PI]  O2_A1 poor quality
12:06:04  0:01:37  [PI]  O1_A2 poor quality
12:06:12  0:01:41  4:O1_A2   Popping
12:06:29  0:01:42  5:O2_A1   Other: temporary saturation, not popping
12:06:41  0:01:54  [PI]  O1_A2 poor quality
12:06:45  0:01:57  4:O1_A2   Popping
12:06:46  0:01:58  [PI]  O2_A1 poor quality
12:07:07  0:02:08  5:O2_A1
12:07:08  0:02:08  [PI]  O1_A2 poor quality
12:07:10  0:02:09  4:O1_A2   Popping
12:07:35  0:02:34  [PI]  EKG poor quality
12:07:35  0:02:34  [PI]  O2_A1 poor quality
12:07:39  0:02:36  EKG   Noise
12:08:08  0:02:37  5:O2_A1   Popping Other: yet all signal are varying rapidly and
somewhat saturating
12:08:19  0:02:47  EKG   Noise
12:08:23  0:02:49  4:O1_A2   Popping
12:08:34  0:03:00  [PI]  O2_A1 poor quality
12:08:58  0:03:23  EKG   Noise
12:09:01  0:03:25  [PI]  EKG poor quality
12:09:06  0:03:30  [PI]  O2_A1 poor quality
12:09:08  0:03:32  [PI]  C4_A1 poor quality
12:09:35  0:03:34  5:O2_A1   Other: not popping -- all signal indicating same saturation
variation
12:09:43  0:03:39  4:O1_A2   Popping
12:09:45  0:03:40  [PI]  C3_A2 poor quality
12:09:54  0:03:45  6:EOG_L   Noise
12:09:59  0:03:50  [PI]  O2_A1 poor quality
12:10:13  0:03:57  4:O1_A2   Popping
12:10:22  0:04:06  [PI]  O2_A1 poor quality
12:10:26  0:04:07  4:O1_A2   Popping
12:10:52  0:04:33  [PI]  O1_A2 poor quality
12:10:53  0:04:34  [PI]  O2_A1 poor quality
12:10:57  0:04:36  4:O1_A2   Popping
12:11:01  0:04:38  5:O2_A1   Popping
```

```
12:11:15  0:04:49  EKG   Noise
12:11:19  0:04:54  [PI]  O2_A1 poor quality
12:11:21  0:04:55  4:O1_A2   Popping
12:11:31  0:05:05  [PI]  EKG poor quality
12:11:36  0:05:07  EKG   Noise
12:11:42  0:05:14  [PI]  O2_A1 poor quality
12:12:14  0:05:17  5:O2_A1   Other: all signals are violently saturating, not popping
12:12:21  0:05:24  [PI]  C4_A1 poor quality
12:12:22  0:05:25  [PI]  C3_A2 poor quality
12:12:41  0:05:41  4:O1_A2   Popping
12:12:58  0:05:57  4:O1_A2   Popping
12:13:46  0:06:43  EKG   Noise
12:13:46  0:06:43  [PI]  O1_A2 poor quality
12:13:52  0:06:48  6:EOG_L   Noise
12:14:02  0:06:58  [PI]  C3_A2 poor quality
12:14:07  0:06:59  2:C3_A2   Popping
12:14:09  0:07:02  [PI]  EOG_L poor quality
12:14:23  0:07:10  6:EOG_L   Noise
12:14:32  0:07:11  7:EOG_R   Other: violent eye movement?
12:14:35  0:07:14  [PI]  O1_A2 poor quality
12:14:49  0:07:21  4:O1_A2   Other: not popping
12:14:57  0:07:29  [PI]  O1_A2 poor quality
12:14:58  0:07:30  [PI]  O2_A1 poor quality
12:15:14  0:07:36  5:O2_A1   Other: saturation, not popping
12:15:17  0:07:37  4:O1_A2   Popping
12:15:32  0:07:48  5:O2_A1   Popping
12:15:35  0:07:49  4:O1_A2   Popping
12:15:44  0:07:58  [PI]  O1_A2 poor quality
12:15:49  0:08:01  4:O1_A2   Popping
12:15:51  0:08:03  [PI]  EOG_L poor quality
12:15:56  0:08:08  [PI]  EOG_R poor quality
12:16:29  0:08:10  6:EOG_L   Other: quick, large eye movement? not popping or flat
12:16:51  0:08:12  7:EOG_R   Other: same as EOG_L -- quick, large eye movement
12:16:52  0:08:13  [PI]  O1_A2 poor quality
12:17:03  0:08:16  4:O1_A2   Other: saturation, not popping
12:17:05  0:08:18  [PI]  EOG_R poor quality
12:17:16  0:08:26  7:EOG_R   Other: no problem
12:17:18  0:08:27  [PI]  EOG_L poor quality
12:17:19  0:08:28  [PI]  EOG_R poor quality
12:17:25  0:08:31  6:EOG_L   Other: no problem
12:17:34  0:08:39  [PI]  O2_A1 poor quality
12:17:39  0:08:41  4:O1_A2   Popping
12:18:05  0:08:48  5:O2_A1   Flat
12:18:15  0:08:58  [PI]  O2_A1 poor quality
12:18:24  0:09:07  [PI]  EOG_R poor quality
12:18:29  0:09:12  [PI]  EOG_L poor quality
12:19:09  0:09:52  [PI]  O1_A2 poor quality
12:19:09  0:09:52  [PI]  O2_A1 poor quality
12:19:39  0:09:54  5:O2_A1   Other: short-term saturation, maybe a loose electrode
12:19:42  0:09:56  4:O1_A2   Popping
12:20:03  0:10:16  [PI]  O2_A1 poor quality
12:20:05  0:10:18  [PI]  O1_A2 poor quality
12:20:31  0:10:19  5:O2_A1   Other: no problem -- all EEGs are swinging violently, not
popping
12:20:46  0:10:25  4:O1_A2   Popping
12:21:16  0:10:35  6:EOG_L   Other: EOG_L is definitely more noisy than EOG_R
12:21:19  0:10:39  [PI]  O1_A2 poor quality
12:21:20  0:10:40  [PI]  O2_A1 poor quality
12:21:26  0:10:44  4:O1_A2   Popping
12:21:26  0:10:44  [PI]  EOG_L poor quality
12:21:26  0:10:44  [PI]  EOG_R poor quality
12:21:36  0:10:49  5:O2_A1   Popping
12:21:58  0:10:50  6:EOG_L   Other: consistent eye movement on both EOG channels, no
problem
12:22:13  0:11:04  4:O1_A2   Popping
12:22:42  0:11:32  [PI]  O1_A2 poor quality
12:22:48  0:11:35  4:O1_A2   Popping
12:22:54  0:11:39  4:O1_A2   Popping
12:23:20  0:12:04  [PI]  O1_A2 poor quality
12:23:20  0:12:04  [PI]  O2_A1 poor quality
12:23:32  0:12:07  4:O1_A2   Popping
```

```
12:23:47  0:12:09  5:O2_A1   Other: looks like it's just saturatıng momentarily
12:23:47  0:12:09  [ PI]  EOG_L poor quality
12:23:51  0:12:13  [ PI]  EOG_R poor quality
12:24:00  0:12:14  6:EOG_L   Other: no problem, consistent eye movement
12:24:28  0:12:42  [ PI]  O2_A1 poor quality
12:24:45  0:12:46  5:O2_A1   Flat Other: 3 second saturation
12:25:14  0:13:15  [ PI]  O1_A2 poor quality
12:25:14  0:13:15  [ PI]  O2_A1 poor quality
12:25:22  0:13:18  4:O1_A2   Poppıng
12:25:23  0:13:19  [ PI]  C4_A1 poor quality
12:25:24  0:13:20  [ PI]  EOG_R poor quality
12:25:35  0:13:21  5:O2_A1   Other: all sıgnals doing some form of saturation
12:25:50  0:13:25  7:EOG_R   Other: no problem -- consistent eye movement
12:26:00  0:13:36  [ PI]  O2_A1 poor quality
12:26:06  0:13:42  [ PI]  O1_A2 poor quality
12:26:12  0:13:46  4:O1_A2   Popping
12:26:15  0:13:50  [ PI]  EOG_R poor quality
12:26:19  0:13:54  [ PI]  O1_A2 poor quality
12:26:28  0:14:01  4:O1_A2   Poppıng
12:26:52  0:14:25  [ PI]  O2_A1 poor quality
12:27:00  0:14:29  5:O2_A1   Other: saturation
12:27:07  0:14:32  4:O1_A2   Other: saturation
12:27:53  0:15:18  [ PI]  O1_A2 poor quality
12:27:55  0:15:20  [ PI]  O2_A1 poor quality
12:27:57  0:15:22  [ PI]  C3_A2 poor quality
12:27:58  0:15:23  [ PI]  C4_A1 poor quality
12:28:02  0:15:24  5:O2_A1   Other: not poppıng
12:28:08  0:15:26  4:O1_A2   Other: not popping
12:28:18  0:15:26  2:C3_A2   Other: consistent among all channels
12:28:39  0:15:26  6:EOG_L   Noise Other: last second noıse
```

sub11111.txt

```
Data file used:   C:/PI/DATAFILE/RICK_6~1.VPD
9:13:17  0:00:19  [ PI]  O1_A2 poor qualıty
9:13:17  0:00:19  [ PI]  C4_A1 poor quality
9:13:17  0:00:19  [ PI]  O2_A1 poor quality
9:13:39  0:00:20  3:C4_A1   Popping
9:14:04  0:00:22  4:O1_A2
9:14:18  0:00:27  4:O1_A2   Popping
9:14:26  0:00:34  [ PI]  O2_A1 poor quality
9:14:26  0:00:35  [ PI]  EKG poor quality
9:14:43  0:00:37  5:O2_A1   Popping
9:14:46  0:00:38  4:O1_A2   Popping
9:14:58  0:00:42  EKG   Noise
9:15:28  0:01:12  [ PI]  O1_A2 poor quality
9:15:29  0:01:13  [ PI]  EKG poor quality
9:15:39  0:01:16  EKG   Noise
9:15:41  0:01:17  [ PI]  O2_A1 poor qualıty
9:15:50  0:01:19  5:O2_A1   Poppıng
9:16:07  0:01:36  [ PI]  O2_A1 poor quality
9:16:08  0:01:37  [ PI]  O1_A2 poor quality
9:16:41  0:01:39  5:O2_A1
9:16:55  0:01:54  [ PI]  O1_A2 poor quality
9:17:00  0:01:55  4:O1_A2   Popping
9:17:03  0:01:58  [ PI]  O2_A1 poor quality
9:17:06  0:02:00  5:O2_A1   Popping
9:17:15  0:02:08  [ PI]  O1_A2 poor quality
9:17:19  0:02:10  4:O1_A2   Popping
9:17:35  0:02:18  5:O2_A1
9:17:52  0:02:34  [ PI]  EKG poor qualıty
9:17:52  0:02:34  [ PI]  O2_A1 poor quality
9:17:55  0:02:36  5:O2_A1   Popping
9:17:59  0:02:37  EKG   Noise
9:18:09  0:02:40  2:C3_A2
9:18:29  0:03:00  [ PI]  O2_A1 poor quality
9:18:33  0:03:02  5:O2_A1   Poppıng
9:18:56  0:03:25  [ PI]  EKG poor quality
```

```
9:19:01  0:03:27  EKG   Noise
9:19:05  0:03:30  [PI]  O2_A1 poor quality
9:19:11  0:03:32  5:O2_A1   Popping
9:19:11  0:03:32  [PI]  C4_A1 poor quality
9:19:19  0:03:34  3:C4_A1   Popping
9:19:25  0:03:40  [PI]  C3_A2 poor quality
9:19:30  0:03:43  2:C3_A2   Popping
9:19:38  0:03:50  [PI]  O2_A1 poor quality
9:19:46  0:03:52  5:O2_A1   Popping
9:20:00  0:04:06  [PI]  O2_A1 poor quality
9:20:16  0:04:08  5:O2_A1   Popping
9:20:42  0:04:33  [PI]  O1_A2 poor quality
9:20:43  0:04:34  [PI]  O2_A1 poor quality
9:20:48  0:04:35  4:O1_A2   Popping
9:20:55  0:04:38  5:O2_A1   Popping
9:21:11  0:04:54  [PI]  O2_A1 poor quality
9:21:21  0:04:57  5:O2_A1
9:21:29  0:05:05  [PI]  EKG poor quality
9:21:34  0:05:07  EKG   Noise
9:21:41  0:05:14  [PI]  O2_A1 poor quality
9:21:47  0:05:15  4:O1_A2   Popping
9:21:53  0:05:18  5:O2_A1   Popping
9:22:00  0:05:24  [PI]  C4_A1 poor quality
9:22:01  0:05:25  [PI]  C3_A2 poor quality
9:22:08  0:05:27  3:C4_A1   Popping
9:22:11  0:05:28  2:C3_A2   Popping
9:23:26  0:06:43  [PI]  O1_A2 poor quality
9:23:34  0:06:49  4:O1_A2
9:23:44  0:06:58  [PI]  C3_A2 poor quality
9:23:52  0:07:00  2:C3_A2   Popping
9:23:53  0:07:02  [PI]  EOG_L poor quality
9:23:59  0:07:04  3:C4_A1   Popping
9:24:04  0:07:07  6:EOG_L   Popping
9:24:12  0:07:14  [PI]  O1_A2 poor quality
9:24:16  0:07:17  4:O1_A2   Popping
9:24:32  0:07:29  EKG   Noise
9:24:32  0:07:29  [PI]  O1_A2 poor quality
9:24:33  0:07:30  [PI]  O2_A1 poor quality
9:24:38  0:07:31  4:O1_A2   Popping
9:24:43  0:07:33  5:O2_A1   Popping
9:25:08  0:07:58  [PI]  O1_A2 poor quality
9:25:12  0:08:00  4:O1_A2   Popping
9:25:15  0:08:03  [PI]  EOG_L poor quality
9:25:20  0:08:08  [PI]  EOG_R poor quality
9:25:30  0:08:09  6:EOG_L   Popping
9:25:35  0:08:11  7:EOG_R   Popping
9:25:37  0:08:13  [PI]  O1_A2 poor quality
9:25:42  0:08:18  [PI]  EOG_R poor quality
9:25:51  0:08:27  [PI]  EOG_L poor quality
9:25:52  0:08:28  [PI]  EOG_R poor quality
9:26:03  0:08:35  6:EOG_L
9:26:07  0:08:39  [PI]  O2_A1 poor quality
9:26:11  0:08:41  5:O2_A1   Popping
9:26:25  0:08:47  5:O2_A1   Flat
9:26:32  0:08:50  4:O1_A2   Popping
9:26:40  0:08:58  [PI]  O2_A1 poor quality
9:26:49  0:09:03  5:O2_A1
9:26:54  0:09:07  [PI]  EOG_R poor quality
9:26:59  0:09:12  [PI]  EOG_L poor quality
9:27:39  0:09:52  [PI]  O1_A2 poor quality
9:27:39  0:09:52  [PI]  O2_A1 poor quality
9:27:51  0:10:02  4:O1_A2   Popping
9:28:05  0:10:16  [PI]  O2_A1 poor quality
9:28:09  0:10:18  5:O2_A1   Popping
9:28:09  0:10:18  [PI]  O1_A2 poor quality
9:28:13  0:10:20  4:O1_A2   Popping
9:28:32  0:10:39  [PI]  O1_A2 poor quality
9:28:33  0:10:40  [PI]  O2_A1 poor quality
9:28:37  0:10:43  5:O2_A1   Popping
9:28:40  0:10:44  4:O1_A2   Popping
9:28:41  0:10:44  [PI]  EOG_L poor quality
```

```
9:28:41  0:10:44  [ PI]  EOG_R poor quality
9:28:48  0:10:49  6:EOG_L   Flat
9:29:32  0:11:32  [ PI]  O1_A2 poor quality
9:29:36  0:11:34  4:O1_A2   Popping
9:30:06  0:12:04  [ PI]  O1_A2 poor quality
9:30:06  0:12:04  [ PI]  O2_A1 poor quality
9:30:19  0:12:07  5:O2_A1   Popping
9:30:21  0:12:08  4:O1_A2   Popping
9:30:23  0:12:09  [ PI]  EOG_L poor quality
9:30:27  0:12:13  [ PI]  EOG_R poor quality
9:30:56  0:12:42  [ PI]  O2_A1 poor quality
9:31:00  0:12:44  5:O2_A1   Flat
9:31:31  0:13:15  [ PI]  O1_A2 poor quality
9:31:31  0:13:15  [ PI]  O2_A1 poor quality
9:31:36  0:13:17  5:O2_A1   Flat
9:31:40  0:13:18  4:O1_A2   Popping
9:31:41  0:13:19  [ PI]  C4_A1 poor quality
9:31:42  0:13:20  [ PI]  EOG_R poor quality
9:31:48  0:13:21  5:O2_A1   Popping
9:32:03  0:13:36  [ PI]  O2_A1 poor quality
9:32:11  0:13:40  5:O2_A1   Popping
9:32:13  0:13:42  [ PI]  O1_A2 poor quality
9:32:17  0:13:45  4:O1_A2   Popping
9:32:22  0:13:50  [ PI]  EOG_R poor quality
9:32:26  0:13:54  [ PI]  O1_A2 poor quality
9:32:31  0:13:56  4:O1_A2   Popping
9:32:46  0:14:09  5:O2_A1   Popping
9:33:02  0:14:25  [ PI]  O2_A1 poor quality
9:33:05  0:14:26  5:O2_A1
9:33:09  0:14:28  5:O2_A1   Popping
9:33:19  0:14:36  3:C4_A1   Popping
9:34:01  0:15:18  [ PI]  O1_A2 poor quality
9:34:03  0:15:20  [ PI]  O2_A1 poor quality
9:34:06  0:15:21  4:O1_A2   Popping
9:34:07  0:15:22  [ PI]  C3_A2 poor quality
9:34:13  0:15:23  5:O2_A1   Popping
9:34:14  0:15:23  [ PI]  C4_A1 poor quality
9:34:16  0:15:25  3:C4_A1   Popping
9:34:19  0:15:26  2:C3_A2   Popping
```

sub11120.txt

```
9:08:43  0:00:04  2:C3_A2   Popping
9:08:52  0:00:08  2:C3_A2
9:08:56  0:00:10  3:C4_A1   Popping
9:09:10  0:00:12  5:O2_A1   Popping
9:09:21  0:00:19  3:C4_A1   Popping
9:09:21  0:00:19  [ PI]  O1_A2 poor quality
9:09:21  0:00:19  [ PI]  C4_A1 poor quality
9:09:21  0:00:19  [ PI]  O2_A1 poor quality
9:09:24  0:00:21  5:O2_A1   Popping
9:09:30  0:00:23  4:O1_A2   Popping
9:09:42  0:00:34  [ PI]  O2_A1 poor quality
9:09:43  0:00:35  [ PI]  EKG poor quality
9:09:49  0:00:36  2:C3_A2   Popping
9:09:54  0:00:38  EKG   Noise
9:10:10  0:00:49  4:O1_A2   Flat
9:10:28  0:01:03  EKG   Noise
9:10:37  0:01:12  [ PI]  O1_A2 poor quality
9:10:45  0:01:13  4:O1_A2   Popping
9:10:45  0:01:13  [ PI]  EKG poor quality
9:10:50  0:01:15  2:C3_A2   Popping
9:10:54  0:01:17  3:C4_A1   Popping
9:10:54  0:01:17  [ PI]  O2_A1 poor quality
9:10:57  0:01:18  5:O2_A1   Popping
9:11:15  0:01:36  [ PI]  O2_A1 poor quality
9:11:16  0:01:37  [ PI]  O1_A2 poor quality
9:11:22  0:01:39  4:O1_A2   Popping
9:11:37  0:01:54  [ PI]  O1_A2 poor quality
9:11:48  0:01:58  5:O2_A1   Popping
```

```
9:11:48  0:01:58  [ PI]  O2_A1 poor quality
9:11:50  0:01:59  3:C4_A1   Popping
9:11:54  0:02:00  4:O1_A2   Popping
9:12:02  0:02:08  [ PI]  O1_A2 poor quality
9:12:11  0:02:12  4:O1_A2   Popping
9:12:16  0:02:13  5:O2_A1   Popping
9:12:38  0:02:28  5:O2_A1   Popping
9:12:42  0:02:29  4:O1_A2   Popping
9:12:49  0:02:33  EKG
9:12:50  0:02:34  [ PI]  EKG poor quality
9:12:50  0:02:34  [ PI]  O2_A1 poor quality
9:12:55  0:02:35  EKG   Noise
9:13:01  0:02:36  5:O2_A1   Popping
9:13:04  0:02:37  3:C4_A1   Popping
9:13:07  0:02:38  2:C3_A2   Popping
9:13:11  0:02:40  4:O1_A2   Popping
9:13:22  0:02:46  EKG   Noise
9:13:38  0:02:58  4:O1_A2   Popping
9:13:42  0:02:59  EKG   Noise
9:13:43  0:03:00  [ PI]  O2_A1 poor quality
9:14:02  0:03:15  4:O1_A2   Popping
9:14:06  0:03:16  5:O2_A1   Popping
9:14:16  0:03:24  5:O2_A1   Popping
9:14:22  0:03:25  3:C4_A1   Popping
9:14:22  0:03:25  [ PI]  EKG poor quality
9:14:28  0:03:27  4:O1_A2   Popping
9:14:32  0:03:30  EKG   Noise
9:14:33  0:03:30  [ PI]  O2_A1 poor quality
9:14:35  0:03:32  [ PI]  C4_A1 poor quality
9:14:42  0:03:34  2:C3_A2   Popping
9:14:52  0:03:40  4:O1_A2   Popping
9:14:52  0:03:40  [ PI]  C3_A2 poor quality
9:14:54  0:03:41  2:C3_A2   Popping
9:14:58  0:03:42  3:C4_A1   Popping
9:15:01  0:03:43  5:O2_A1   Popping
9:15:08  0:03:50  [ PI]  O2_A1 poor quality
9:15:23  0:03:58  5:O2_A1
9:15:35  0:04:05  4:O1_A2
9:15:37  0:04:06  [ PI]  O2_A1 poor quality
9:15:52  0:04:09  4:O1_A2   Popping
9:15:56  0:04:10  5:O2_A1   Popping
9:16:19  0:04:33  [ PI]  O1_A2 poor quality
9:16:20  0:04:34  [ PI]  O2_A1 poor quality
9:16:29  0:04:36  3:C4_A1   Popping
9:16:31  0:04:37  5:O2_A1   Popping
9:16:36  0:04:38  2:C3_A2   Popping
9:16:39  0:04:38  4:O1_A2   Popping
9:16:51  0:04:48  EKG   Noise
9:16:56  0:04:54  [ PI]  O2_A1 poor quality
9:17:07  0:05:05  [ PI]  EKG poor quality
9:17:14  0:05:07  4:O1_A2   Popping
9:17:19  0:05:08  5:O2_A1   Popping
9:17:19  0:05:09  3:C4_A1
9:17:22  0:05:10  3:C4_A1   Popping
9:17:26  0:05:14  [ PI]  O2_A1 poor quality
9:17:30  0:05:17  5:O2_A1   Popping
9:17:32  0:05:18  3:C4_A1   Popping
9:17:34  0:05:19  2:C3_A2   Popping
9:17:36  0:05:20  4:O1_A2   Popping
9:17:42  0:05:23  EKG   Noise
9:17:43  0:05:24  [ PI]  C4_A1 poor quality
9:17:44  0:05:25  [ PI]  C3_A2 poor quality
9:18:16  0:05:54  4:O1_A2   Popping
9:18:51  0:06:25  4:O1_A2   Popping
9:19:06  0:06:34  5:O2_A1   Popping
9:19:14  0:06:43  [ PI]  O1_A2 poor quality
9:19:19  0:06:45  EKG   Noise
9:19:32  0:06:58  [ PI]  C3_A2 poor quality
9:19:36  0:06:59  2:C3_A2   Popping
9:19:38  0:07:00  3:C4_A1   Popping
9:19:41  0:07:02  [ PI]  EOG_L poor quality
```

```
9:19:49  0:07:05  7:EOG_R   Popping
9:19:51  0:07:06  6:EOG_L   Popping
9:19:59  0:07:14  [ PI]  O1_A2 poor quality
9:20:17  0:07:27  2:C3_A2   Noise
9:20:22  0:07:28  4:O1_A2   Noise
9:20:23  0:07:29  [ PI]  O1_A2 poor quality
9:20:24  0:07:30  [ PI]  O2_A1 poor quality
9:20:26  0:07:32  4:O1_A2
9:20:28  0:07:34  4:O1_A2   Popping
9:20:35  0:07:40  5:O2_A1   Popping
9:20:37  0:07:41  3:C4_A1   Popping
9:20:38  0:07:42  2:C3_A2   Popping
9:20:54  0:07:58  [ PI]  O1_A2 poor quality
9:20:59  0:08:03  [ PI]  EOG_L poor quality
9:21:04  0:08:08  [ PI]  EOG_R poor quality
9:21:09  0:08:13  [ PI]  O1_A2 poor quality
9:21:14  0:08:18  [ PI]  EOG_R poor quality
9:21:18  0:08:20  4:O1_A2   Popping
9:21:25  0:08:27  [ PI]  EOG_L poor quality
9:21:26  0:08:28  [ PI]  EOG_R poor quality
9:21:31  0:08:30  4:O1_A2   Popping
9:21:40  0:08:39  [ PI]  O2_A1 poor quality
9:21:46  0:08:40  5:O2_A1   Popping
9:21:49  0:08:41  3:C4_A1   Popping
9:21:54  0:08:45  4:O1_A2   Popping
9:22:03  0:08:48  5:O2_A1   Flat
9:22:13  0:08:58  [ PI]  O2_A1 poor quality
9:22:28  0:09:04  7:EOG_R   Popping
9:22:31  0:09:07  [ PI]  EOG_R poor quality
9:22:35  0:09:09  2:C3_A2   Noise
9:22:39  0:09:11  4:O1_A2   Noise
9:22:40  0:09:12  [ PI]  EOG_L poor quality
9:23:20  0:09:52  [ PI]  O1_A2 poor quality
9:23:20  0:09:52  [ PI]  O2_A1 poor quality
9:23:26  0:09:54  4:O1_A2   Popping
9:23:48  0:10:16  [ PI]  O2_A1 poor quality
9:23:53  0:10:17  5:O2_A1   Popping
9:23:57  0:10:18  3:C4_A1   Popping
9:23:57  0:10:18  [ PI]  O1_A2 poor quality
9:24:00  0:10:19  2:C3_A2   Popping
9:24:03  0:10:20  4:O1_A2   Popping
9:24:14  0:10:27  5:O2_A1   Flat
9:24:27  0:10:39  [ PI]  O1_A2 poor quality
9:24:28  0:10:40  [ PI]  O2_A1 poor quality
9:24:35  0:10:43  5:O2_A1   Popping
9:24:39  0:10:44  4:O1_A2   Popping
9:24:39  0:10:44  [ PI]  EOG_L poor quality
9:24:39  0:10:44  [ PI]  EOG_R poor quality
9:24:51  0:10:53  2:C3_A2   Popping
9:24:54  0:10:54  3:C4_A1   Popping
9:24:56  0:10:55  5:O2_A1   Popping
9:25:00  0:10:56  4:O1_A2   Popping
9:25:36  0:11:32  [ PI]  O1_A2 poor quality
9:25:43  0:11:35  4:O1_A2   Popping
9:25:46  0:11:36  2:C3_A2   Popping
9:25:48  0:11:37  5:O2_A1   Popping
9:25:52  0:11:38  3:C4_A1   Popping
9:26:18  0:12:04  [ PI]  O1_A2 poor quality
9:26:18  0:12:04  [ PI]  O2_A1 poor quality
9:26:25  0:12:07  4:O1_A2   Popping
9:26:27  0:12:08  3:C4_A1   Popping
9:26:30  0:12:09  5:O2_A1   Popping
9:26:30  0:12:09  [ PI]  EOG_L poor quality
9:26:34  0:12:13  [ PI]  EOG_R poor quality
9:27:03  0:12:42  [ PI]  O2_A1 poor quality
9:27:09  0:12:44  5:O2_A1   Flat
9:27:40  0:13:15  [ PI]  O1_A2 poor quality
9:27:40  0:13:15  [ PI]  O2_A1 poor quality
9:27:45  0:13:17  4:O1_A2   Popping
9:27:49  0:13:19  5:O2_A1   Popping
9:27:49  0:13:19  [ PI]  C4_A1 poor quality
```

```
9:27:51  0:13:20  3:C4_A1   Popping
9:27:52  0:13:20  [PI]  EOG_R poor quality
9:27:53  0:13:21  2:C3_A2   Popping
9:27:59  0:13:27  EKG   Noise
9:28:09  0:13:36  [PI]  O2_A1 poor quality
9:28:15  0:13:39  5:O2_A1   Popping
9:28:18  0:13:40  4:O1_A2   Popping
9:28:20  0:13:42  [PI]  O1_A2 poor quality
9:28:28  0:13:50  [PI]  EOG_R poor quality
9:28:32  0:13:54  [PI]  O1_A2 poor quality
9:28:37  0:13:57  4:O1_A2   Popping
9:28:39  0:13:58  5:O2_A1   Popping
9:28:52  0:14:09  3:C4_A1   Popping
9:28:54  0:14:10  2:C3_A2   Popping
9:28:57  0:14:11  4:O1_A2   Poppıng
9:28:59  0:14:12  5:O2_A1   Popping
9:29:12  0:14:25  [PI]  O2_A1 poor quality
9:29:25  0:14:37  4:O1_A2   Popping
9:29:28  0:14:38  2:C3_A2   Popping
9:29:30  0:14:39  3:C4_A1   Popping
9:29:32  0:14:40  5:O2_A1   Popping
9:30:10  0:15:18  [PI]  O1_A2 poor quality
9:30:12  0:15:20  [PI]  O2_A1 poor quality
9:30:15  0:15:21  5:O2_A1   Popping
9:30:17  0:15:22  3:C4_A1   Popping
9:30:17  0:15:22  [PI]  C3_A2 poor quality
9:30:19  0:15:23  2:C3_A2   Popping
9:30:19  0:15:23  [PI]  C4_A1 poor quality
9:30:22  0:15:24  4:O1_A2   Popping
```

sub12111.txt

```
Data file used:   C:/PI/DATAFI~1/RICK_6~1.VPD
10:13:46  0:00:19  [PI]  O1_A2 poor quality
10:13:46  0:00:19  [PI]  C4_A1 poor quality
10:13:46  0:00:19  [PI]  O2_A1 poor quality
10:13:54  0:00:22  4:O1_A2   Poppıng
10:14:06  0:00:29  3:C4_A1   Popping
10:14:11  0:00:34  [PI]  O2_A1 poor quality
10:14:12  0:00:35  [PI]  EKG poor quality
10:14:20  0:00:37  5:O2_A1   Popping
10:14:26  0:00:39  5:O2_A1   Popping
10:14:32  0:00:42  4:O1_A2   Popping
10:14:38  0:00:45  EKG   Noise
10:14:47  0:00:49  4:O1_A2   Flat
10:15:10  0:01:10  4:O1_A2   Poppıng
10:15:12  0:01:12  [PI]  O1_A2 poor quality
10:15:13  0:01:13  [PI]  EKG poor quality
10:15:25  0:01:17  EKG   Noise
10:15:25  0:01:17  [PI]  O2_A1 poor qualıty
10:15:28  0:01:19  5:O2_A1   Popping
10:15:35  0:01:21  4:O1_A2   Popping
10:15:41  0:01:26  5:O2_A1   Popping
10:15:52  0:01:30  4:O1_A2   Popping
10:15:59  0:01:36  [PI]  O2_A1 poor quality
10:16:00  0:01:37  [PI]  O1_A2 poor quality
10:16:11  0:01:39  4:O1_A2   Noise
10:16:20  0:01:46  5:O2_A1   Flat
10:16:28  0:01:54  [PI]  O1_A2 poor quality
10:16:32  0:01:58  [PI]  O2_A1 poor quality
10:16:40  0:01:59  4:O1_A2   Popping
10:16:44  0:02:00  5:O2_A1   Popping
10:16:52  0:02:08  [PI]  O1_A2 poor quality
10:16:58  0:02:12  4:O1_A2   Flat
10:17:07  0:02:19  5:O2_A1   Poppıng
10:17:13  0:02:24  4:O1_A2   Flat
10:17:23  0:02:34  [PI]  EKG poor quality
10:17:23  0:02:34  [PI]  O2_A1 poor quality
10:17:29  0:02:38  EKG   Noise
10:17:35  0:02:41  5:O2_A1   Popping
```

```
10:17:38  0:02:42  4:O1_A2   Popping
10:17:55  0:02:58  4:O1_A2   Popping
10:18:00  0:02:59  5:O2_A1   Popping
10:18:01  0:03:00  [ PI]  O2_A1 poor quality
10:18:19  0:03:08  4:O1_A2   Popping
10:18:22  0:03:09  5:O2_A1   Popping
10:18:32  0:03:17  4:O1_A2   Flat
10:18:40  0:03:25  [ PI]  EKG poor quality
10:18:46  0:03:27  EKG   Noise
10:18:52  0:03:29  4:O1_A2   Popping
10:18:52  0:03:30  [ PI]  O2_A1 poor quality
10:18:54  0:03:32  [ PI]  C4_A1 poor quality
10:18:58  0:03:33  5:O2_A1   Popping
10:19:01  0:03:35  3:C4_A1   Popping
10:19:05  0:03:37  4:O1_A2   Popping
10:19:09  0:03:39  EKG   Noise
10:19:10  0:03:40  [ PI]  C3_A2 poor quality
10:19:28  0:03:48  4:O1_A2   Popping
10:19:32  0:03:50  2:C3_A2   Popping
10:19:33  0:03:50  [ PI]  O2_A1 poor quality
10:19:36  0:03:52  5:O2_A1   Popping
10:19:44  0:03:58  4:O1_A2   Flat
10:19:49  0:03:59  5:O2_A1   Popping
10:19:51  0:04:00  2:C3_A2   Popping
10:19:58  0:04:06  [ PI]  O2_A1 poor quality
10:20:02  0:04:10  5:O2_A1   Popping
10:20:07  0:04:12  4:O1_A2   Popping
10:20:10  0:04:14  4:O1_A2   Flat
10:20:19  0:04:21  4:O1_A2   Popping
10:20:30  0:04:33  [ PI]  O1_A2 poor quality
10:20:31  0:04:34  [ PI]  O2_A1 poor quality
10:20:43  0:04:38  4:O1_A2   Popping Flat
10:20:45  0:04:39  5:O2_A1   Popping
10:20:53  0:04:45  4:O1_A2   Popping
10:20:56  0:04:47  5:O2_A1   Popping
10:21:01  0:04:50  EKG   Noise
10:21:05  0:04:54  [ PI]  O2_A1 poor quality
10:21:10  0:04:57  4:O1_A2   Flat
10:21:13  0:04:58  5:O2_A1   Popping
10:21:20  0:05:05  [ PI]  EKG poor quality
10:21:25  0:05:07  EKG   Noise
10:21:29  0:05:10  4:O1_A2   Popping
10:21:34  0:05:14  [ PI]  O2_A1 poor quality
10:21:37  0:05:17  5:O2_A1   Popping
10:21:41  0:05:19  3:C4_A1   Popping
10:21:46  0:05:24  [ PI]  C4_A1 poor quality
10:21:47  0:05:25  [ PI]  C3_A2 poor quality
10:21:50  0:05:26  5:O2_A1   Popping
10:21:52  0:05:27  3:C4_A1   Popping
10:21:54  0:05:28  2:C3_A2   Popping
10:21:58  0:05:29  4:O1_A2   Popping
10:22:08  0:05:38  4:O1_A2   Popping
10:22:21  0:05:49  4:O1_A2   Popping
10:22:39  0:06:05  4:O1_A2   Popping
10:23:16  0:06:43  [ PI]  O1_A2 poor quality
10:23:22  0:06:47  4:O1_A2   Popping
10:23:33  0:06:58  [ PI]  C3_A2 poor quality
10:23:36  0:07:00  2:C3_A2   Popping
10:23:38  0:07:02  [ PI]  EOG_L poor quality
10:23:45  0:07:07  6:EOG_L   Popping
10:23:47  0:07:08  2:C3_A2   Popping
10:23:52  0:07:11  2:C3_A2   Popping
10:23:54  0:07:14  [ PI]  O1_A2 poor quality
10:23:58  0:07:16  4:O1_A2   Popping
10:24:05  0:07:22  4:O1_A2   Popping
10:24:12  0:07:29  [ PI]  O1_A2 poor quality
10:24:17  0:07:30  4:O1_A2   Popping
10:24:18  0:07:30  [ PI]  O2_A1 poor quality
10:24:21  0:07:32  EKG   Noise
10:24:25  0:07:34  5:O2_A1   Popping
10:24:28  0:07:36  4:O1_A2   Popping
```

```
10:24:31  0:07:39  2:C3_A2   Popping
10:24:36  0:07:42  5:O2_A1   Flat
10:24:46  0:07:49  5:O2_A1   Popping
10:24:48  0:07:51  4:O1_A2   Popping
10:24:55  0:07:58  [ PI]  O1_A2 poor quality
10:25:03  0:08:00  4:O1_A2   Popping
10:25:06  0:08:03  [ PI]  EOG_L poor quality
10:25:11  0:08:08  [ PI]  EOG_R poor quality
10:25:19  0:08:09  6:EOG_L   Noise
10:25:27  0:08:11  7:EOG_R   Flat Noise
10:25:29  0:08:13  [ PI]  O1_A2 poor quality
10:25:35  0:08:17  4:O1_A2   Popping
10:25:37  0:08:18  [ PI]  EOG_R poor quality
10:25:46  0:08:21  7:EOG_R   Popping Flat
10:25:52  0:08:25  4:O1_A2   Flat
10:25:54  0:08:27  [ PI]  EOG_L poor quality
10:25:55  0:08:28  [ PI]  EOG_R poor quality
10:26:01  0:08:29  4:O1_A2   Flat
10:26:07  0:08:30  6:EOG_L   Flat
10:26:09  0:08:31  7:EOG_R   Flat
10:26:18  0:08:39  [ PI]  O2_A1 poor quality
10:26:21  0:08:40  4:O1_A2   Popping
10:26:23  0:08:41  5:O2_A1   Popping
10:26:30  0:08:47  5:O2_A1   Flat
10:26:36  0:08:52  4:O1_A2   Popping
10:26:42  0:08:58  [ PI]  O2_A1 poor quality
10:26:46  0:09:00  5:O2_A1   Flat
10:26:53  0:09:07  [ PI]  EOG_R poor quality
10:26:57  0:09:10  7:EOG_R   Flat
10:27:00  0:09:12  [ PI]  EOG_L poor quality
10:27:40  0:09:52  [ PI]  O1_A2 poor quality
10:27:40  0:09:52  [ PI]  O2_A1 poor quality
10:27:51  0:09:54  4:O1_A2   Popping
10:27:59  0:09:55  5:O2_A1   Popping
10:28:19  0:10:16  [ PI]  O2_A1 poor quality
10:28:23  0:10:18  5:O2_A1   Popping
10:28:23  0:10:18  [ PI]  O1_A2 poor quality
10:28:26  0:10:20  4:O1_A2   Popping
10:28:44  0:10:36  5:O2_A1   Flat
10:28:47  0:10:39  [ PI]  O1_A2 poor quality
10:28:48  0:10:40  [ PI]  O2_A1 poor quality
10:28:52  0:10:42  5:O2_A1   Popping
10:28:53  0:10:44  [ PI]  EOG_L poor quality
10:28:53  0:10:44  [ PI]  EOG_R poor quality
10:28:56  0:10:45  4:O1_A2   Popping
10:29:07  0:10:49  6:EOG_L   Flat
10:29:12  0:10:50  5:O2_A1   Popping
10:29:16  0:10:52  7:EOG_R   Popping
10:29:23  0:10:59  4:O1_A2   Popping
10:29:31  0:11:06  4:O1_A2   Popping
10:29:57  0:11:32  [ PI]  O1_A2 poor quality
10:30:08  0:11:37  4:O1_A2   Popping
10:30:36  0:12:04  [ PI]  O1_A2 poor quality
10:30:36  0:12:04  [ PI]  O2_A1 poor quality
10:30:48  0:12:06  4:O1_A2   Popping
10:30:51  0:12:07  5:O2_A1   Popping
10:30:52  0:12:09  [ PI]  EOG_L poor quality
10:30:56  0:12:13  [ PI]  EOG_R poor quality
10:31:05  0:12:18  7:EOG_R   Noise
10:31:16  0:12:28  4:O1_A2   Popping
10:31:30  0:12:42  [ PI]  O2_A1 poor quality
10:31:34  0:12:44  5:O2_A1   Flat
10:32:05  0:13:15  [ PI]  O1_A2 poor quality
10:32:05  0:13:15  [ PI]  O2_A1 poor quality
10:32:11  0:13:18  5:O2_A1   Popping
10:32:11  0:13:19  [ PI]  C4_A1 poor quality
10:32:14  0:13:20  4:O1_A2   Popping
10:32:14  0:13:20  [ PI]  EOG_R poor quality
10:32:17  0:13:21  3:C4_A1   Popping
10:32:20  0:13:24  5:O2_A1   Popping
10:32:25  0:13:27  7:EOG_R   Popping
```

```
10:32:35  0:13:36  [PI]  O2_A1 poor quality
10:32:39  0:13:38  5:O2_A1   Popping
10:32:42  0:13:42  [PI]  O1_A2 poor quality
10:32:47  0:13:45  4:O1_A2   Popping
10:32:50  0:13:48  5:O2_A1   Popping
10:32:52  0:13:50  [PI]  EOG_R poor quality
10:33:02  0:13:53  7:EOG_R   Noise
10:33:04  0:13:54  [PI]  O1_A2 poor quality
10:33:07  0:13:56  7:EOG_R   Popping
10:33:10  0:13:57  4:O1_A2   Popping
10:33:15  0:14:00  5:O2_A1   Popping
10:33:22  0:14:06  4:O1_A2   Popping
10:33:37  0:14:19  4:O1_A2   Popping
10:33:42  0:14:25  [PI]  O2_A1 poor quality
10:33:45  0:14:27  4:O1_A2   Popping
10:33:47  0:14:28  5:O2_A1   Popping
10:33:56  0:14:34  2:C3_A2   Popping
10:33:58  0:14:35  3:C4_A1   Popping
10:34:05  0:14:40  4:O1_A2   Flat
10:34:09  0:14:42  5:O2_A1   Popping
10:34:16  0:14:48  5:O2_A1   Popping
10:34:18  0:14:49  4:O1_A2   Popping
10:34:27  0:14:56  5:O2_A1   Popping
10:34:32  0:14:58  4:O1_A2   Popping
10:34:52  0:15:18  [PI]  O1_A2 poor quality
10:34:56  0:15:20  4:O1_A2   Popping
10:34:56  0:15:20  [PI]  O2_A1 poor quality
10:34:58  0:15:22  [PI]  C3_A2 poor quality
10:35:02  0:15:23  5:O2_A1   Popping
10:35:02  0:15:23  [PI]  C4_A1 poor quality
10:35:05  0:15:25  2:C3_A2   Popping
10:35:07  0:15:26  4:O1_A2   Popping
```

sub12120.txt

```
10:08:58  0:00:19  [PI]  O1_A2 poor quality
10:08:58  0:00:19  [PI]  C4_A1 poor quality
10:08:58  0:00:19  [PI]  O2_A1 poor quality
10:09:15  0:00:33  4:O1_A2   Popping
10:09:16  0:00:34  [PI]  O2_A1 poor quality
10:09:17  0:00:35  [PI]  EKG poor quality
10:09:19  0:00:36  2:C3_A2   Popping
10:09:23  0:00:38  EKG   Noise
10:09:29  0:00:42  6:EOG_L   Popping
10:09:31  0:00:44  5:O2_A1   Popping
10:09:40  0:00:49  4:O1_A2   Flat
10:09:43  0:00:51  2:C3_A2   Popping
10:09:52  0:00:58  4:O1_A2   Popping
10:10:02  0:01:07  EKG   Noise
10:10:07  0:01:11  4:O1_A2   Popping
10:10:08  0:01:12  [PI]  O1_A2 poor quality
10:10:09  0:01:13  [PI]  EKG poor quality
10:10:13  0:01:17  [PI]  O2_A1 poor quality
10:10:17  0:01:19  4:O1_A2   Popping
10:10:19  0:01:20  2:C3_A2   Popping
10:10:22  0:01:21  3:C4_A1   Popping
10:10:24  0:01:22  5:O2_A1   Popping
10:10:27  0:01:23  EKG   Noise
10:10:39  0:01:30  6:EOG_L   Popping
10:10:42  0:01:31  7:EOG_R   Popping
10:10:47  0:01:36  [PI]  O2_A1 poor quality
10:10:48  0:01:37  [PI]  O1_A2 poor quality
10:11:01  0:01:44  6:EOG_L   Noise
10:11:04  0:01:46  7:EOG_R   Noise
10:11:10  0:01:50  4:O1_A2   Popping
10:11:14  0:01:54  [PI]  O1_A2 poor quality
10:11:18  0:01:58  [PI]  O2_A1 poor quality
10:11:21  0:01:59  5:O2_A1   Popping
10:11:23  0:02:01  3:C4_A1   Popping
10:11:25  0:02:02  2:C3_A2   Popping
```

10:11:27 0:02:03 4:O1_A2   Popping
10:11:33 0:02:05 EKG   Noise
10:11:36 0:02:08 [PI] O1_A2 poor quality
10:11:47 0:02:17 6:EOG_L   Popping
10:11:50 0:02:18 7:EOG_R   Popping
10:11:56 0:02:22 4:O1_A2   Popping
10:12:02 0:02:24 2:C3_A2   Popping
10:12:06 0:02:27 5:O2_A1   Popping
10:12:09 0:02:29 4:O1_A2   Popping
10:12:15 0:02:32 3:C4_A1   Popping
10:12:17 0:02:34 5:O2_A1   Popping
10:12:18 0:02:34 [PI] EKG poor quality
10:12:18 0:02:34 [PI] O2_A1 poor quality
10:12:22 0:02:37 EKG   Noise
10:12:26 0:02:40 4:O1_A2   Popping
10:12:29 0:02:41 2:C3_A2   Popping
10:12:31 0:02:42 3:C4_A1   Popping
10:12:34 0:02:43 5:O2_A1   Popping
10:12:38 0:02:45 EKG   Noise
10:12:42 0:02:49 6:EOG_L   Popping
10:12:45 0:02:50 7:EOG_R   Popping
10:12:55 0:03:00 [PI] O2_A1 poor quality
10:13:01 0:03:05 4:O1_A2   Popping
10:13:04 0:03:06 2:C3_A2   Popping
10:13:06 0:03:07 3:C4_A1   Poppıng
10:13:16 0:03:08 5:O2_A1   Popping
10:13:28 0:03:19 4:O1_A2   Popping
10:13:30 0:03:20 2:C3_A2   Popping
10:13:32 0:03:21 3:C4_A1   Popping
10:13:35 0:03:23 5:O2_A1   Popping
10:13:38 0:03:25 [PI] EKG poor quality
10:13:40 0:03:26 EKG   Noise
10:13:44 0:03:30 [PI] O2_A1 poor quality
10:13:46 0:03:32 [PI] C4_A1 poor quality
10:13:48 0:03:33 4:O1_A2   Poppıng
10:13:50 0:03:34 2:C3_A2   Popping
10:13:53 0:03:35 3:C4_A1   Popping
10:13:56 0:03:36 5:O2_A1   Popping
10:13:59 0:03:37 EKG   Noise
10:14:07 0:03:40 6:EOG_L   Noise
10:14:07 0:03:40 [PI] C3_A2 poor quality
10:14:17 0:03:50 [PI] O2_A1 poor quality
10:14:22 0:03:51 4:O1_A2   Popping
10:14:28 0:03:52 2:C3_A2
10:14:32 0:03:55 2:C3_A2   Popping
10:14:34 0:03:56 3:C4_A1   Popping
10:14:37 0:03:57 5:O2_A1   Popping
10:14:40 0:03:58 EKG   Noıse
10:14:47 0:04:06 [PI] O2_A1 poor quality
10:14:49 0:04:07 6:EOG_L   Poppıng
10:14:51 0:04:08 7:EOG_R   Popping
10:14:59 0:04:11 4:O1_A2   Popping
10:15:02 0:04:12 2:C3_A2   Popping
10:15:05 0:04:13 3:C4_A1   Popping
10:15:09 0:04:16 5:O2_A1   Popping
10:15:26 0:04:33 [PI] O1_A2 poor quality
10:15:27 0:04:34 [PI] O2_A1 poor quality
10:15:40 0:04:39 4:O1_A2   Popping
10:15:43 0:04:40 2:C3_A2   Popping
10:15:45 0:04:41 3:C4_A1   Popping
10:15:50 0:04:42 5:O2_A1   Popping
10:15:59 0:04:47 6:EOG_L
10:16:02 0:04:48 7:EOG_R   Popping
10:16:05 0:04:50 5:O2_A1   Popping
10:16:07 0:04:51 2:C3_A2   Popping
10:16:10 0:04:53 4:O1_A2   Popping
10:16:11 0:04:54 [PI] O2_A1 poor quality
10:16:16 0:04:58 EKG   Noise
10:16:23 0:05:05 [PI] EKG poor quality
10:16:28 0:05:08 4:O1_A2   Popping
10:16:29 0:05:09 2:C3_A2   Poppıng

10:16:31 0:05:10 3:C4_A1   Popping
10:16:34 0:05:11 5:O2_A1   Popping
10:16:37 0:05:12 EKG   Noise
10:16:41 0:05:14 4:O1_A2   Popping
10:16:41 0:05:14 [PI] O2_A1 poor quality
10:16:43 0:05:15 2:C3_A2   Popping
10:16:45 0:05:16 3:C4_A1   Popping
10:16:52 0:05:19 5:O2_A1   Popping
10:16:55 0:05:20 EKG   Noise
10:16:59 0:05:24 [PI] C4_A1 poor quality
10:17:00 0:05:25 [PI] C3_A2 poor quality
10:17:03 0:05:27 4:O1_A2   Popping
10:17:05 0:05:28 2:C3_A2   Popping
10:17:11 0:05:29 3:C4_A1   Popping
10:17:15 0:05:31 6:EOG_L   Noise
10:17:29 0:05:41 6:EOG_L   Popping
10:17:31 0:05:42 4:O1_A2   Popping
10:17:34 0:05:43 2:C3_A2   Popping
10:17:37 0:05:45 3:C4_A1   Popping
10:17:40 0:05:47 5:O2_A1   Popping
10:17:47 0:05:53 EKG   Noise
10:17:52 0:05:56 4:O1_A2   Popping
10:18:06 0:06:08 4:O1_A2   Popping
10:18:09 0:06:09 5:O2_A1   Popping
10:18:11 0:06:10 3:C4_A1   Popping
10:18:23 0:06:20 4:O1_A2   Popping
10:18:29 0:06:21 5:O2_A1   Popping
10:18:35 0:06:26 4:O1_A2   Popping
10:18:39 0:06:29 5:O2_A1   Popping
10:18:56 0:06:43 EKG   Noise
10:18:56 0:06:43 [PI] O1_A2 poor quality
10:19:03 0:06:50 4:O1_A2   Popping
10:19:11 0:06:58 [PI] C3_A2 poor quality
10:19:17 0:07:00 2:C3_A2   Popping
10:19:20 0:07:01 3:C4_A1   Popping
10:19:21 0:07:02 [PI] EOG_L poor quality
10:19:29 0:07:08 2:C3_A2   Popping
10:19:33 0:07:09 3:C4_A1   Popping
10:19:37 0:07:11 7:EOG_R   Popping
10:19:39 0:07:12 6:EOG_L   Popping
10:19:41 0:07:14 [PI] O1_A2 poor quality
10:19:44 0:07:16 4:O1_A2   Popping
10:19:47 0:07:17 2:C3_A2   Popping
10:19:49 0:07:18 3:C4_A1   Popping
10:19:54 0:07:19 5:O2_A1   Popping
10:20:00 0:07:24 6:EOG_L
10:20:05 0:07:29 [PI] O1_A2 poor quality
10:20:08 0:07:30 4:O1_A2   Popping
10:20:08 0:07:30 [PI] O2_A1 poor quality
10:20:10 0:07:31 2:C3_A2   Popping
10:20:12 0:07:32 3:C4_A1   Popping
10:20:26 0:07:42 5:O2_A1   Popping
10:20:29 0:07:43 3:C4_A1   Popping
10:20:31 0:07:44 4:O1_A2   Popping
10:20:34 0:07:46 2:C3_A2   Popping
10:20:39 0:07:50 4:O1_A2   Popping
10:20:42 0:07:51 2:C3_A2   Popping
10:20:44 0:07:52 3:C4_A1   Popping
10:20:47 0:07:53 5:O2_A1   Popping
10:20:51 0:07:58 [PI] O1_A2 poor quality
10:20:56 0:08:03 [PI] EOG_L poor quality
10:21:01 0:08:08 [PI] EOG_R poor quality
10:21:03 0:08:09 4:O1_A2   Popping
10:21:06 0:08:10 2:C3_A2   Popping
10:21:09 0:08:13 3:C4_A1   Popping
10:21:09 0:08:13 [PI] O1_A2 poor quality
10:21:11 0:08:14 5:O2_A1   Popping
10:21:15 0:08:18 [PI] EOG_R poor quality
10:21:18 0:08:20 4:O1_A2   Popping
10:21:21 0:08:21 2:C3_A2   Popping
10:21:27 0:08:27 [PI] EOG_L poor quality

```
10:21:28  0:08:28  [ PI]  EOG_R poor quality
10:21:33  0:08:29  4:O1_A2   Flat
10:21:54  0:08:38  5:O2_A1   Popping
10:21:54  0:08:39  [ PI]  O2_A1 poor quality
10:21:56  0:08:40  5:O2_A1   Popping
10:22:03  0:08:43  7:EOG_R   Popping
10:22:07  0:08:46  5:O2_A1   Flat
10:22:19  0:08:58  [ PI]  O2_A1 poor quality
10:22:25  0:09:01  3:C4_A1   Popping
10:22:30  0:09:04  7:EOG_R   Popping
10:22:33  0:09:07  [ PI]  EOG_R poor quality
10:22:38  0:09:08  6:EOG_L   Popping
10:22:40  0:09:09  3:C4_A1   Popping
10:22:43  0:09:12  [ PI]  EOG_L poor quality
10:22:50  0:09:17  5:O2_A1   Poppıng
10:22:57  0:09:22  10:EMGlsm   Popping
10:23:23  0:09:47  2:C3_A2   Popping
10:23:28  0:09:52  [ PI]  O1_A2 poor quality
10:23:28  0:09:52  [ PI]  O2_A1 poor quality
10:23:33  0:09:56  4:O1_A2   Popping
10:23:36  0:09:57  5:O2_A1   Popping
10:23:55  0:10:16  [ PI]  O2_A1 poor quality
10:23:57  0:10:17  5:O2_A1   Popping
10:23:59  0:10:18  3:C4_A1   Popping
10:23:59  0:10:18  [ PI]  O1_A2 poor qualıty
10:24:01  0:10:19  2:C3_A2   Popping
10:24:03  0:10:20  4:O1_A2   Popping
10:24:15  0:10:29  5:O2_A1   Flat
10:24:21  0:10:33  4:O1_A2   Popping
10:24:27  0:10:39  [ PI]  O1_A2 poor quality
10:24:28  0:10:40  [ PI]  O2_A1 poor quality
10:24:32  0:10:43  4:O1_A2   Popping
10:24:33  0:10:44  [ PI]  EOG_L poor quality
10:24:33  0:10:44  [ PI]  EOG_R poor quality
10:24:35  0:10:45  2:C3_A2   Popping
10:24:38  0:10:46  3:C4_A1   Popping
10:24:42  0:10:48  5:O2_A1   Popping
10:24:53  0:10:50  7:EOG_R
10:24:56  0:10:52  6:EOG_L   Flat
10:25:04  0:10:59  4:O1_A2   Popping
10:25:09  0:11:00  2:C3_A2   Popping
10:25:11  0:11:01  3:C4_A1   Poppıng
10:25:14  0:11:02  5:O2_A1   Popping
10:25:20  0:11:06  EKG   Noise
10:25:29  0:11:15  5:O2_A1   Popping
10:25:46  0:11:32  [ PI]  O1_A2 poor qualıty
10:25:49  0:11:34  4:O1_A2   Popping
10:25:51  0:11:35  2:C3_A2   Popping
10:25:54  0:11:38  3:C4_A1   Popping
10:25:56  0:11:39  5:O2_A1   Poppıng
10:26:20  0:12:01  4:O1_A2   Popping
10:26:23  0:12:04  [ PI]  O1_A2 poor quality
10:26:23  0:12:04  [ PI]  O2_A1 poor quality
10:26:27  0:12:06  4:O1_A2   Popping
10:26:30  0:12:07  5:O2_A1   Popping
10:26:32  0:12:08  3:C4_A1   Popping
10:26:33  0:12:09  [ PI]  EOG_L poor quality
10:26:37  0:12:13  [ PI]  EOG_R poor quality
10:26:52  0:12:28  4:O1_A2   Poppıng
10:26:56  0:12:30  5:O2_A1   Popping
10:27:05  0:12:38  7:EOG_R   Popping
10:27:10  0:12:42  [ PI]  O2_A1 poor quality
10:27:16  0:12:46  5:O2_A1   Flat
10:27:39  0:13:07  4:O1_A2   Popping
10:27:47  0:13:15  [ PI]  O1_A2 poor quality
10:27:47  0:13:15  [ PI]  O2_A1 poor quality
10:27:51  0:13:17  4:O1_A2   Popping
10:27:54  0:13:18  2:C3_A2   Popping
10:27:57  0:13:19  3:C4_A1   Popping
10:27:57  0:13:19  [ PI]  C4_A1 poor quality
10:28:00  0:13:20  5:O2_A1   Popping
```

```
10:28:00  0:13:20  [ PI]  EOG_R poor quality
10:28:06  0:13:21  7:EOG_R
10:28:09  0:13:23  EKG   Noise
10:28:15  0:13:27  4:O1_A2   Popping
10:28:18  0:13:29  5:O2_A1   Popping
10:28:25  0:13:36  [ PI]  O2_A1 poor quality
10:28:29  0:13:40  5:O2_A1   Popping
10:28:32  0:13:41  4:O1_A2   Popping
10:28:34  0:13:42  2:C3_A2   Popping
10:28:34  0:13:42  [ PI]  O1_A2 poor quality
10:28:36  0:13:43  3:C4_A1   Popping
10:28:41  0:13:47  4:O1_A2   Popping
10:28:44  0:13:48  2:C3_A2
10:28:46  0:13:49  3:C4_A1   Popping
10:28:47  0:13:50  5:O2_A1   Popping
10:28:48  0:13:50  [ PI]  EOG_R poor quality
10:28:52  0:13:54  [ PI]  O1_A2 poor quality
10:28:55  0:13:56  4:O1_A2   Popping
10:28:57  0:13:58  2:C3_A2   Popping
10:29:00  0:14:00  3:C4_A1   Popping
10:29:06  0:14:03  5:O2_A1   Popping
10:29:11  0:14:08  4:O1_A2   Popping
10:29:15  0:14:09  2:C3_A2   Popping
10:29:21  0:14:11  3:C4_A1   Popping
10:29:25  0:14:12  EKG   Noise
10:29:34  0:14:21  4:O1_A2   Popping
10:29:36  0:14:22  2:C3_A2   Popping
10:29:39  0:14:24  3:C4_A1   Popping
10:29:39  0:14:25  [ PI]  O2_A1 poor quality
10:29:42  0:14:27  5:O2_A1   Popping
10:29:53  0:14:36  4:O1_A2   Popping
10:29:56  0:14:38  2:C3_A2   Popping
10:29:59  0:14:39  3:C4_A1   Popping
10:30:01  0:14:40  5:O2_A1   Popping
10:30:09  0:14:47  4:O1_A2   Popping
10:30:11  0:14:49  2:C3_A2   Popping
10:30:13  0:14:50  3:C4_A1   Popping
10:30:16  0:14:51  5:O2_A1   Popping
10:30:32  0:15:05  EKG   Noise
10:30:45  0:15:18  [ PI]  O1_A2 poor quality
10:30:48  0:15:20  5:O2_A1   Popping
10:30:48  0:15:20  [ PI]  O2_A1 poor quality
10:30:50  0:15:21  4:O1_A2   Popping
10:30:52  0:15:22  2:C3_A2   Popping
10:30:52  0:15:22  [ PI]  C3_A2 poor quality
10:30:53  0:15:23  [ PI]  C4_A1 poor quality
10:30:55  0:15:24  3:C4_A1   Popping
10:30:57  0:15:26  4:O1_A2   Popping
10:30:59  0:15:26  2:C3_A2   Popping
```

APPENDIX H

Data

The data presented in this appendix was manipulated using Microsoft Excel and Systat. In order to perform a variety of statistical analyses (such as ANOVA), the same data was re-arranged in two different manners: a univariate form and a repeated measures form. The data presented in the following pages is tabulated in the repeated measures format.

SUBJECT	DAY	DATE	PHASE	PIHELP	LAPTOP	R(1)	R(2)	R(3)	R(4)	R(5)	R(6)	R(7)	R(8)
1	1	13	1	0	3	-9	30	30	8	30	35	30	4
1	2	14	1	1	3	13	25	36	18	14	5	13	7
2	1	13	1	1	5	26	36	52	21	27	-4	4	20
2	2	14	1	0	5	6	-5	0	3	16	6	-5	9
3	1	13	1	0	2	-5	4	10	30	30	30	10	30
3	2	14	1	1	2	6	-6	-2	3	14	10	-4	4
4	1	13	1	0	4	0	42	30	17	30	7	30	3
4	2	14	1	1	4	14	19	26	10	6	25	6	0
5	1	13	1	0	1	-2	30	30	38	30	7	30	10
5	2	14	1	1	1	30	26	30	19	30	30	9	30
6	1	13	1	1	3	30	30	30	30	30	10	51	30
6	2	14	1	0	3	-1	30	30	30	5	30	30	30
7	1	13	1	1	2	11	20	30	9	19	30	5	5
7	2	14	1	0	2	4	15	30	18	19	-2	4	-3
8	1	13	1	1	4	4	30	30	10	30	28	5	6
8	2	14	1	0	4	9	29	30	11	-4	20	30	-7
9	1	13	1	0	6	0	30	30	5	30	20	30	30
9	2	14	1	1	6	5	9	13	17	7	30	6	11
10	1	13	1	0	5	0	5	10	30	30	30	30	35
10	2	14	1	1	5	8	30	19	20	9	5	8	6
11	1	13	1	1	1	47	22	30	17	32	30	10	9
11	2	14	1	0	1	9	0	3	30	11	8	30	3
12	1	13	1	1	6	8	20	30	9	26	-2	12	3
12	2	14	1	0	6	17	30	30	15	6	-1	18	11

R(9)	R(10)	R(11)	R(12)	R(13)	R(14)	R(15)	R(16)	R(17)	R(18)	R(19)	R(20)	R(21)	R(22)
30	30	13	0	10	30	21	5	30	-9	8	27	30	4
16	20	4	2	0	9	0	-5	2	6	8	9	4	-1
16	9	-4	13	5	17	12	-3	5	-11	-6	10	11	7
-4	3	3	6	0	4	-6	-1	-2	11	2	14	9	12
30	15	5	30	30	7	30	16	4	30	30	30	30	30
11	5	3	7	11	4	-4	4	-4	-5	4	-6	14	4
18	15	-5	54	7	30	12	30	-1	30	28	30	30	30
4	30	10	0	26	7	-1	5	-2	-6	11	30	5	9
30	7	12	3	8	30	39	30	-1	35	30	30	30	30
30	30	30	30	30	6	12	11	24	30	30	29	8	30
38	-2	9	30	25	46	30	-4	18	65	30	22	30	9
22	53	25	20	30	13	-5	14	-1	30	30	30	30	5
10	30	12	3	30	11	6	5	16	33	27	13	4	3
30	30	4	12	4	4	-3	0	-1	3	3	11	14	9
7	9	4	6	-8	0	-7	4	7	5	30	17	15	17
5	7	3	-4	-2	10	-4	4	0	14	30	-3	12	13
30	30	7	7	30	16	30	30	30	30	30	30	30	11
30	30	5	3	30	20	4	5	0	7	11	17	30	3
30	30	13	30	30	20	12	30	6	30	30	30	30	18
26	-2	4	21	2	4	33	30	-3	29	30	30	30	30
34	30	5	3	4	7	3	4	5	6	8	5	8	16
30	6	17	0	9	-1	11	23	10	28	23	2	15	19
21	11	12	12	6	6	12	-1	6	6	7	22	3	4
30	22	13	3	20	4	-1	21	2	12	7	21	20	22

R(23)	R(24)	R(25)	R(26)	R(27)	R(28)	R(29)	R(30)	R(31)	R(32)	R(33)	R(34)	R(35)	R(36)
17	10	13	30	-4	13	10	5	24	15	18	6	9	6
5	10	-9	8	5	6	9	14	4	12	3	14	-5	-24
5	16	0	4	-1	11	7	6	3	6	15	6	2	34
4	12	5	17	-5	19	15	6	4	3	3	14	4	6
-6	16	30	15	30	25	19	-6	10	6	30	23	-4	-4
12	8	8	7	12	30	30	-8	5	5	-6	19	7	0
20	30	30	20	30	19	30	7	11	34	-3	28	8	5
10	20	11	6	6	3	30	10	4	30	12	4	7	30
30	30	30	30	30	30	30	30	23	30	30	27	30	30
12	7	30	30	6	30	10	16	30	30	13	18	30	30
30	12	-5	10	19	67	-5	-4	7	31	30	26	5	30
30	29	13	6	29	30	30	30	5	30	30	0	30	30
12	14	9	7	4	6	3	4	4	4	4	9	4	34
12	4	12	30	-3	16	30	12	-3	13	7	13	30	30
9	6	30	30	4	4	6	8	4	3	14	6	9	21
10	5	-6	4	-7	8	2	8	2	3	5	8	4	7
9	6	21	30	30	15	30	30	3	9	-4	7	14	12
7	15	13	30	-7	30	0	30	3	30	8	10	30	30
30	30	30	10	6	30	30	12	17	30	27	23	30	30
5	8	30	5	32	30	30	30	5	14	20	16	5	11
6	12	10	5	12	8	10	8	8	4	6	10	4	30
20	11	23	35	4	30	30	30	4	23	3	11	30	9
13	14	8	5	3	-5	7	6	3	4	5	7	8	6
14	23	-6	14	-7	12	5	7	6	3	3	18	12	9

R(37)	R(38)	R(39)	R(40)	R(41)	R(42)	R(43)	R(44)	R(45)	R(46)	R(47)	R(48)	R(49)	R(50)
6	5	5	12	12	-1	19	9	71	46	11	35	43	4
0	5	11	6	4	7	27	21	4	7	3	4	8	4
2	7	4	7	4	8	8	14	4	3	0	10	3	7
-8	5	3	7	0	5	6	15	3	7	3	3	4	13
15	30	6	9	2	10	6	12	4	8	17	4	5	15
4	9	5	7	10	0	10	13	4	3	7	6	6	11
7	30	4	7	25	-1	6	14	8	4	30	4	4	30
6	5	0	3	4	5	-5	4	3	12	16	3	6	8
17	30	8	30	30	22	28	30	11	30	30	19	8	30
16	30	21	30	30	8	30	30	30	14	8	12	20	30
33	21	-5	9	5	16	-1	19	9	30	17	30	30	8
3	30	30	30	18	30	30	30	12	6	30	30	30	7
12	4	19	15	10	5	4	9	3	11	8	3	8	6
13	30	30	30	0	6	30	16	30	20	30	9	30	12
-1	30	3	6	0	2	9	5	11	6	3	5	6	3
6	3	2	7	0	2	5	11	7	5	2	8	6	4
11	30	5	12	3	30	30	10	5	30	6	5	6	10
6	30	14	6	16	0	30	8	4	16	4	3	7	4
21	30	10	30	30	30	30	30	30	8	30	14	30	21
31	30	33	30	28	41	7	16	6	12	27	17	8	21
4	9	12	30	4	4	8	0	4	15	13	4	9	5
6	30	6	30	5	6	12	7	7	7	12	6	5	9
5	4	11	19	4	3	9	-4	11	12	15	4	9	6
0	31	5	8	2	4	5	14	3	-3	7	6	4	13

R(51)	R(52)	R(53)	R(54)	R(55)	R(56)	R(57)	R(58)	R(59)	RIGHT_ID	WRONG_ID	MISSES
12	26	16	13	50	16	3	7	3	39	10	10
6	5	4	9	5	6	5	30	30	50	7	2
3	3	-4	5	-1	4	-4	6	5	54	5	0
2	-3	-4	8	-9	6	-6	-5	4	52	7	0
5	30	30	30	30	30	30	30	30	26	8	25
8	-5	5	6	21	13	4	0	4	46	11	2
30	5	4	12	30	8	30	30	30	29	10	20
30	3	11	21	4	9	5	30	4	39	13	7
30	30	7	30	30	30	30	30	30	15	6	38
7	30	13	9	30	30	30	30	30	18	8	33
30	10	30	16	7	6	30	10	21	28	13	18
30	7	30	17	8	30	30	30	30	19	6	34
3	5	5	6	9	9	4	9	3	49	6	4
3	30	30	8	-6	11	3	2	-2	36	7	16
-1	4	-2	2	9	8	-4	-6	2	43	9	7
5	2	-5	6	0	5	-7	-4	9	51	5	3
30	6	6	13	12	4	12	3	4	29	5	25
30	6	5	4	8	5	14	2	4	38	7	14
11	30	30	12	38	20	9	13	9	24	3	32
30	30	6	9	8	15	7	21	30	42	3	14
30	8	4	5	3	5	10	12	2	48	7	4
2	6	-2	5	20	12	3	2	-2	41	9	9
6	4	5	6	5	4	6	7	30	50	7	2
0	4	-2	3	3	5	0	0	2	48	8	3

AVE_RESP	AVE_POP	AVE_FLAT	AVE_NOISE	FLAT(1)	FLAT(2)	FLAT(3)	FLAT(4)	FLAT(5)
16.6440678	14.55555556	3.013968943	30	30	6	5	12	9
7.93220339	7.911111111	1.842989969	9.2	16	0	5	6	21
8.050847458	7.844444444	1.69616223	11.4	16	2	7	7	14
4.186440678	4.4	0.026313657	6	-4	-8	5	7	15
17.42372881	17.48888889	2.977317708	13.2	30	15	30	9	12
5.983050847	5.755555556	1.387606096	3.4	11	4	9	7	13
18.42372881	18.51111111	1.98126061	21.8	18	7	30	7	14
10.23728814	12.02222222	0.804239969	4.6	4	6	5	3	4
24.84745763	24.46666667	2.98027392	23.8	30	17	30	30	30
22.77966102	22.37777778	2.970384838	19.8	30	16	30	30	30
20.69491525	19.8	3.57111304	31	38	33	21	9	19
22.54237288	24.66666667	2.228556134	10.6	22	3	30	30	30
10.50847458	10.86666667	1.195182292	11.6	10	12	4	15	9
13.10169492	12.28888889	2.858031443	11.2	30	13	30	30	16
8.525423729	8.066666667	0.945397377	14.4	7	-1	30	6	5
5.677966102	5.533333333	0.77603588	8	5	6	3	7	11
17.13559322	16.64444444	3.014402971	27.2	30	11	30	12	10
12.6779661	12.97777778	3.008042052	12.6	30	6	30	6	8
23.05084746	22.66666667	2.977934028	19.2	30	21	30	30	30
18.18644068	18.68888889	2.639124228	4.6	26	31	30	30	16
11.3220339	11.37777778	3.195762924	11.8	34	4	9	30	0
12.59322034	11.42222222	2.859906443	17	30	6	30	30	7
8.440677966	8.422222222	2.150812114	11	21	5	4	19	-4
9.305084746	8.8	2.898129823	8.8	30	0	31	8	14

FLAT(6)	FLAT(7)	FLAT(8)	FLAT(9)	POP(1)	POP(2)	POP(3)	POP(4)	POP(5)	POP(6)	POP(7)
35	4	26	50	-9	30	30	8	35	4	30
4	4	5	5	13	25	36	18	5	7	20
10	7	3	-1	26	36	52	21	-4	20	9
3	13	-3	-9	6	-5	0	3	6	9	3
4	15	30	30	-5	4	10	30	30	30	15
6	11	-5	21	6	-6	-2	3	10	4	5
4	30	5	30	0	42	30	17	7	3	15
3	8	3	4	14	19	26	10	25	0	30
19	30	30	30	-2	30	30	38	7	10	7
12	30	30	30	30	26	30	19	30	30	30
30	8	10	7	30	30	30	30	10	30	-2
30	7	7	8	-1	30	30	30	30	30	53
3	6	5	9	11	20	30	9	30	5	30
9	12	30	-6	4	15	30	18	-2	-3	30
5	3	4	9	4	30	30	10	28	6	9
8	4	2	0	9	29	30	11	20	-7	7
5	10	6	12	0	30	30	5	20	30	30
3	4	6	8	5	9	13	17	30	11	30
14	21	30	38	0	5	10	30	30	35	30
17	21	30	8	8	30	19	20	5	6	-2
4	5	8	3	47	22	30	17	30	9	30
6	9	6	20	9	0	3	30	8	3	6
4	6	4	5	8	20	30	9	-2	3	11
6	13	4	3	17	30	30	15	-1	11	22

POP(8)	POP(9)	POP(10)	POP(11)	POP(12)	POP(13)	POP(14)	POP(15)	POP(16)	POP(17)
13	0	10	21	5	-9	8	27	30	4
4	2	0	0	-5	6	8	9	4	-1
-4	13	5	12	-3	-11	-6	10	11	7
3	6	0	-6	-1	11	2	14	9	12
5	30	30	30	16	30	30	30	30	30
3	7	11	-4	4	-5	4	-6	14	4
-5	54	7	12	30	30	28	30	30	30
10	0	26	-1	5	-6	11	30	5	9
12	3	8	39	30	35	30	30	30	30
30	30	30	12	11	30	30	29	8	30
9	30	25	30	-4	65	30	22	30	9
25	20	30	-5	14	30	30	30	30	5
12	3	30	6	5	33	27	13	4	3
4	12	4	-3	0	3	3	11	14	9
4	6	-8	-7	4	5	30	17	15	17
3	-4	-2	-4	4	14	30	-3	12	13
7	7	30	30	30	30	30	30	30	11
5	3	30	4	5	7	11	17	30	3
13	30	30	12	30	30	30	30	30	18
4	21	2	33	30	29	30	30	30	30
5	3	4	3	4	6	8	5	8	16
17	0	9	11	23	28	23	2	15	19
12	12	6	12	-1	6	7	22	3	4
13	3	20	-1	21	12	7	21	20	22

POP(18)	POP(19)	POP(20)	POP(21)	POP(22)	POP(23)	POP(24)	POP(25)	POP(26)	POP(27)
17	10	13	-4	13	10	5	24	15	18
5	10	-9	5	6	9	14	4	12	3
5	16	0	-1	11	7	6	3	6	15
4	12	5	-5	19	15	6	4	3	3
-6	16	30	30	25	19	-6	10	6	30
12	8	8	12	30	30	-8	5	5	-6
20	30	30	30	19	30	7	11	34	-3
10	20	11	6	3	30	10	4	30	12
30	30	30	30	30	30	30	23	30	30
12	7	30	6	30	10	16	30	30	13
30	12	-5	19	67	-5	-4	7	31	30
30	29	13	29	30	30	30	5	30	30
12	14	9	4	6	3	4	4	4	4
12	4	12	-3	16	30	12	-3	13	7
9	6	30	4	4	6	8	4	3	14
10	5	-6	-7	8	2	8	2	3	5
9	6	21	30	15	30	30	3	9	-4
7	15	13	-7	30	0	30	3	30	8
30	30	30	6	30	30	12	17	30	27
5	8	30	32	30	30	30	5	14	20
6	12	10	12	8	10	8	8	4	6
20	11	23	4	30	30	30	4	23	3
13	14	8	3	-5	7	6	3	4	5
14	23	-6	-7	12	5	7	6	3	3

POP(28)	POP(29)	POP(30)	POP(31)	POP(32)	POP(33)	POP(34)	POP(35)	POP(36)	POP(37)
6	9	6	5	12	-1	19	71	46	11
14	-5	-24	11	4	7	27	4	7	3
6	2	34	4	4	8	8	4	3	0
14	4	6	3	0	5	6	3	7	3
23	-4	-4	6	2	10	6	4	8	17
19	7	0	5	10	0	10	4	3	7
28	8	5	4	25	-1	6	8	4	30
4	7	30	0	4	5	-5	3	12	16
27	30	30	8	30	22	28	11	30	30
18	30	30	21	30	8	30	30	14	8
26	5	30	-5	5	16	-1	9	30	17
0	30	30	30	18	30	30	12	6	30
9	4	34	19	10	5	4	3	11	8
13	30	30	30	0	6	30	30	20	30
6	9	21	3	0	2	9	11	6	3
8	4	7	2	0	2	5	7	5	2
7	14	12	5	3	30	30	5	30	6
10	30	30	14	16	0	30	4	16	4
23	30	30	10	30	30	30	30	8	30
16	5	11	33	28	41	7	6	12	27
10	4	30	12	4	4	8	4	15	13
11	30	9	6	5	6	12	7	7	12
7	8	6	11	4	3	9	11	12	15
18	12	9	5	2	4	5	3	-3	7

POP(38)	POP(39)	POP(40)	POP(41)	POP(42)	POP(43)	POP(44)	POP(45)	NOISE(1)	NOISE(2)
43	12	16	13	16	3	7	3	30	30
8	6	4	9	6	5	30	30	14	13
3	3	-4	5	4	-4	6	5	27	4
4	2	-4	8	6	-6	-5	4	16	-5
5	5	30	30	30	30	30	30	30	10
6	8	5	6	13	4	0	4	14	-4
4	30	4	12	8	30	30	30	30	30
6	30	11	21	9	5	30	4	6	6
8	30	7	30	30	30	30	30	30	30
20	7	13	9	30	30	30	30	30	9
30	30	30	16	6	30	10	21	30	51
30	30	30	17	30	30	30	30	5	30
8	3	5	6	9	4	9	3	19	5
30	3	30	8	11	3	2	-2	19	4
6	-1	-2	2	8	-4	-6	2	30	5
6	5	-5	6	5	-7	-4	9	-4	30
6	30	6	13	4	12	3	4	30	30
7	30	5	4	5	14	2	4	7	6
30	11	30	12	20	9	13	9	30	30
8	30	6	9	15	7	21	30	9	8
9	30	4	5	5	10	12	2	32	10
5	2	-2	5	12	3	2	-2	11	30
9	6	5	6	4	6	7	30	26	12
4	0	-2	3	5	0	0	2	6	18

NOISE(3)	NOISE(4)	NOISE(5)	GROUPS	ORDER	INDIV	CODEGSI
30	30	30	1	7	0	8
9	2	8	1	7	0	8
17	5	4	0	3	0	4
4	-2	17	0	3	0	4
7	4	15	1	8	1	9
4	-4	7	1	8	1	9
30	-1	20	1	9	2	10
7	-2	6	1	9	2	10
30	-1	30	1	11	0	12
6	24	30	1	11	0	12
46	18	10	0	4	1	5
13	-1	6	0	4	1	5
11	16	7	0	5	2	6
4	-1	30	0	5	2	6
0	7	30	0	1	0	0
10	0	4	0	1	0	0
16	30	30	1	10	3	11
20	0	30	1	10	3	11
20	6	10	1	12	1	13
4	-3	5	1	12	1	13
7	5	5	0	6	3	7
-1	10	35	0	6	3	7
6	6	5	0	2	1	1
4	2	14	0	2	1	1

APPENDIX I

Database Documentation and VBA-Based Data Sorting Routine[3]

Below is the documentation on the database describing table and query definitions. This documentation is followed by the routine's code.

H:\c\My Documents\Susie.mdb
Table: tbl_12120

Wednesday, April 15, 1998
Page: 1

Properties

Date Created:	1/17/98 8:37:25 PM	Def. Updatable	True
Last Updated:	1/17/98 8.37:25 PM	OrderByOn:	False
RecordCount:	59		

Columns

Name	Type	Size
ID	Number (Long)	4
Time1	Text	50
Time2	Text	50
Activity	Text	255
Descr	Text	255
PITime	Text	50
Subject	Text	50

Table Indexes

Name	Number of Fields
ID	1
Fields.	ID, Ascending

H.\c\My Documents\Susie.mdb
Table: tbl_ImportFiles

Wednesday, April 15, 1998
Page: 2

Properties

Date Created:	1/17/98 5:01:24 PM	Def. Updatable:	True
Last Updated:	1/17/98 5.01:24 PM	OrderByOn:	False
RecordCount.	24		

[3] Provided by Kevin Seefried, KSeefried & Associates, Atlanta, GA

Columns

Name	Type	Size
ID	Number (Long)	4
File	Text	50

Table Indexes

Name	Number of Fields
PrimaryKey	1
Fields:	ID, Ascending

Properties

Date Created:	1/16/98 11:48:12 PM	Def. Updatable:	True
Last Updated:	1/17/98 8:37.24 PM	OrderByOn:	False
RecordCount:	283		

Columns

Name	Type	Size
ID	Number (Long)	4
Time1	Text	255
Time2	Text	255
PI	Text	255
Activity	Text	255
Desc	Text	255

Table Indexes

Name	Number of Fields
PrimaryKey	1
Fields:	ID, Ascending

Properties

Date Created:	1/16/98 11:08:15 PM	Def. Updatable:	True
Last Updated:	1/17/98 3:07:16 PM	OrderByOn:	False
RecordCount:	59		

Columns

Name	Type	Size
ID	Number (Long)	4
Time1	Text	50

Time2	Text	50
Activity	Text	255
Descr	Text	255
PITime	Text	50
Subject	Text	50

Table Indexes

Name	Number of Fields
ID	1
Fields:	ID, Ascending

Properties

Date Created:	1/17/98 4:40:46 PM	Def. Updatable:	True
Last Updated:	1/17/98 4:40:48 PM	OrderByOn:	False
RecordCount:	1416		

Columns

Name	Type	Size
ID	Number (Long)	4
Time1	Text	50
Time2	Text	50
Activity	Text	255
Descr	Text	255
PITime	Text	50
Subject	Text	50

Table Indexes

Name	Number of Fields
ID	1
Fields:	ID, Ascending

Properties

Date Created:	1/16/98 11:27:48 PM	Def Updatable:	True
FailOnError:	False	Last Updated:	1/17/98 10:53:48 AM
MaxRecords:	0	ODBCTimeout:	60
Record Locks:	Edited Record	Records Affected:	0
ReturnsRecords:	True	Type:	Delete
UseTransaction:	True		

SQL

```
DELETE tbl_ImportResults.*, tbl_ImportResults.PI, tbl_ImportResults.Activity
FROM tbl_ImportResults
WHERE (((tbl_ImportResults.PI) Like "EOG_L*")) OR (((tbl_ImportResults.Activity) Like "EOG*"));
```


Properties

Date Created:	1/17/98 5:57:59 PM	Def. Updatable:	True
Last Updated:	1/17/98 5:57:59 PM	MaxRecords:	0
ODBCTimeout:	60	OrderByOn:	False
Record Locks.	No Locks	Records Affected:	0
RecordsetType	All Records	ReturnsRecords:	True
Type:	Select		

SQL

```
SELECT tbl_Rollup.Subject, Count(tbl_Rollup.Subject) AS CountOfSubject
FROM tbl_Rollup
GROUP BY tbl_Rollup.Subject
HAVING (((Count(tbl_Rollup.Subject))<>59));
```

Columns

Name	Type	Size
Subject	Text	50
CountOfSubject	Number (Long)	4

Properties

Date Created:	1/16/98 11:20:56 PM	Def. Updatable:	True
FailOnError.	False	Last Updated:	1/17/98 10:53:52 AM
MaxRecords:	0	ODBCTimeout:	60
Record Locks	Edited Record	Records Affected:	0
ReturnsRecords:	True	Type:	Update
UseTransaction:	True		

SQL

```
UPDATE tbl_ImportResults SET tbl_ImportResults.PI = IIf(InStr([PI],":")>0,Mid([PI],InStr([PI],":")+1),[PI]);
```


Properties

Date Created:	1/17/98 11.29:29 AM	Def. Updatable:	True
FailOnError:	False	Last Updated:	1/17/98 11:29:29 AM
MaxRecords:	0	ODBCTimeout:	60
Record Locks:	Edited Record	Records Affected:	0
ReturnsRecords:	True	Type	Update
UseTransaction:	True		

SQL

```
UPDATE tbl_Results SET tbl_Results.Subject = [Enter Subject],
```

Query Parameters

Name	Type
[Enter Subject]	Text

Code

```
 1 Attribute VB_Name = "Form_frmRun"
 2 Attribute VB_Creatable = True
 3 Attribute VB_PredeclaredId = True
 4 Attribute VB_Exposed = False
 5 Option Compare Database
 6 Option Explicit
 7
 8 Private Sub cmdBuild_Click()
 9
10     oResCol.Clear
11     Call Build(txtFile, txtSubject, txtTable)
12
13 End Sub
14
15 Public Function Build(sFile As String, sSubject As String, sTable As String)
16
17     Dim qd As QueryDef
18     Set db = CurrentDb
19     db.Execute "Delete From tbl_ImportResults"
20     DoCmd.TransferText acImportDelim, "Clean sub01110 Import Specification1", _
21                        "tbl_ImportResults", sFile
22
23     Set qd = db.QueryDefs("Delete")
24     qd.Execute
25     Set qd = db.QueryDefs("Strip")
26     qd.Execute
27     RunTest
28     db.Execute "UPDATE tbl_Results SET tbl_Results.Subject = '" & sSubject & "'"
29
30     DoCmd.TransferDatabase acExport, "Microsoft Access", db.Name, acTable, _
31                            "tbl_Results", "tbl_" & sTable
32
33 End Function
34
35 Private Sub cmdBuildAll_Click()
36
37     Dim rs As Recordset
38     Dim sFile As String
```

```
39
40      Set rs = db.OpenRecordset("tbl_ImportFiles", dbOpenDynaset)
41
42      db.Execute "Delete From tbl_Rollup"
43
44      Do Until rs.EOF
45          oResCol.Clear
46          sFile = rs!File
47          gSubject = sFile
48          Call Build("d:\Temp\" & sFile & ".txt", sFile, sFile)
49          'DoCmd.OpenReport "Import Results", acViewNormal
50          DoCmd.OpenReport "Results", acViewNormal
51          DoCmd.OutputTo acOutputTable, "tbl_Results", acFormatXLS, "d:\Temp\" &
sFile
    & ".xls"
52          db.Execute "INSERT INTO tbl_Rollup SELECT tbl_" & sFile & ".* FROM tbl_"
&
    sFile
53          rs.MoveNext
54      Loop
55
56      'DoCmd.OpenReport "ResultsAll", acViewNormal
57      DoCmd.OutputTo acOutputTable, "tbl_Rollup", acFormatXLS,
"d:\Temp\Rollup.xls"
58
59  End Sub
60
61  Private Sub Form_Load()
62      Me.txtFile = "d:\Temp\"
63      Set db = CurrentDb
64  End Sub
```

Code

```
 1  Attribute VB_Name = "Report_Import Results"
 2  Attribute VB_Creatable = True
 3  Attribute VB_PredeclaredId = True
 4  Attribute VB_Exposed = False
 5  Option Compare Database
 6  Option Explicit
 7
 8  Private Sub Detail_Format(Cancel As Integer, FormatCount As Integer)
 9      Me![lblCaption].Caption = "Import Results: " & gSubject
10  End Sub
11
12  Private Sub PageHeader_Format(Cancel As Integer, FormatCount As Integer)
13
14  End Sub
15
```

Properties

Date Created:	1/16/98 11:33:00 PM	Last Updated:	1/17/98 3:05:37 PM
Owner:	admin		

Code

```
 1  Attribute VB_Name = "clsResults"
 2  Attribute VB_Creatable = True
 3  Attribute VB_PredeclaredId = True
 4  Attribute VB_Exposed = False
```

```
 5 Option Compare Database
 6 Option Explıcıt
 7
 8 Prıvate lIndex As Long
 9 Prıvate sName  As String
10 Prıvate sTime1 As String
11 Private sTime2 As String
12 Private sDescr As String
13 Prıvate sPITime As String
14
15 Public Property Get Index() As Long
16     Index = lIndex
17 End Property
18
19 Public Property Let Index(vData As Long)
20     lIndex = vData
21 End Property
22
23 Publıc Property Get PITime() As Strıng
24     PITime = sPITime
25 End Property
26
27 Public Property Let PITıme(vData As String)
28     sPITıme = vData
29 End Property
30
31 Publıc Property Get Name() As Strıng
32     Name = sName
33 End Property
34
35 Public Property Let Name(vData As Strıng)
36     sName = vData
37 End Property
38
39 Public Property Get Tıme1() As String
40     Time1 = sTime1
41 End Property
42
43 Publıc Property Let Time1(vData As String)
44     sTime1 = vData
45 End Property
46
47 Public Property Get Descr() As Strıng
48     Descr = sDescr
49 End Property
50
51 Publıc Property Let Descr(vData As String)
52     sDescr = vData
53 End Property
54
55 Publıc Property Get Time2() As Strıng
56     Time2 = sTime2
57 End Property
58
59 Public Property Let Tıme2(vData As String)
60     sTime2 = vData
61 End Property
```

Properties

Date Created:	1/17/98 12:06:44 AM	Last Updated:	1/17/98 8:19:02 PM
Owner:	admin		

Code

```
 1  Attribute VB_Name = "modGeneral"
 2  Option Compare Database
 3  Option Explicit
 4
 5  Public db As Database
 6  Public rs1  As Recordset
 7  Public oResCol As New ResultsCol
 8  Public gSubject  As String
 9
10  Public Function RunTest()
11
12      Dim i As Integer
13      Dim rs As Recordset
14      Dim bStart As Boolean
15      Dim oRes   As clsResults
16
17      Set rs = db.OpenRecordset("tbl_ImportResults", dbOpenDynaset)
18      Set rs1 = db.OpenRecordset("tbl_Results", dbOpenDynaset)
19
20      db.Execute "Delete from tbl_Results"
21
22      bStart = True
23      oResCol.Clear
24      Set oResCol = New ResultsCol
25
26      Do Until rs.EOF
27
28          ValidateTime rs!Time2
29
30          If rs!PI.Value = "[PI]" Then
31              InsertPI "" & rs!Time1, "" & rs!Activity, rs!Time2, rs!ID
32              bStart = False
33          Else
34              InsertTester "" & rs!Time1, "" & rs!PI, "" & rs!Desc, rs!Time2,
rs!ID

35          End If
36
37          rs.MoveNext
38      Loop
39
40      For i = 1 To oResCol.Count

41          Set oRes = oResCol.Item(i)
42          With oRes
43              If .Time1 <> "" Then
44              rs1.AddNew
45              rs1!ID = .Index
46              rs1!Activity = .Name
47              rs1!Time1 = .Time1
48              rs1!Time2 = Format(DateAdd("s", 30, .Time1), "hh:mm:ss")
49              rs1!Descr = "NO RESPONSE"
50              rs1!PITime = .PITime
51              rs1.Update
52              End If
53          End With
54      Next i
55
56  End Function
```

```
57
58  Public Sub InsertPI(sTime As String, sActivity As String, sPITime As String, lID
As
    Long)
59
60      Dim oResult As clsResults
61
62      Set oResult = oResCol.AddActivity(sActivity)
63
64      With oResult
65          If .Name <> "" Then
66              rs1.AddNew
67              rs1!ID = .Index
68              rs1!Activity = sActivity
69              rs1!Time1 = .Time1
70              rs1!Time2 = Format(DateAdd("s", 30, .Time1), "hh:mm:ss")
71              rs1!Descr = "NO RESPONSE"
72              rs1!PITime = .PITime
73              rs1.Update
74              .Name = sActivity
75              .Time1 = sTime
76              .PITime = sPITime
77              .Index = lID
78          ElseIf .Time2 = "" Then
79              .Name = sActivity
80              .Time1 = sTime
81              .PITime = sPITime
82              .Index = lID
83          Else
84              rs1.AddNew
85              rs1!ID = lID
86              rs1!Activity = sActivity
87              rs1!Time1 = sTime
88              rs1!Time2 = .Time2
89              rs1!Descr = .Descr
90              rs1!PITime = sPITime

91              rs1.Update
92              Clear oResult
93          End If
94
95      End With
96
97  End Sub
98
99  Public Function InsertTester(sTime As String, sActivity As String, sDescr As
String,
    sPITime As String, lID As Long)
100
101     Dim oResult As clsResults
102
103     Set oResult = oResCol.AddActivity(sActivity)
104
105     With oResult
106         If .Time1 = "" Or .Time2 <> "" Then
107             .Time2 = sTime
108             .PITime = sPITime
109             .Descr = sDescr
110         Else
111             rs1.AddNew
112             rs1!ID = .Index
113             rs1!Activity = sActivity
114             rs1!Time1 = .Time1
115             rs1!Time2 = sTime
116             rs1!Descr = IIf(sDescr = "", "NO DESCRIPTION", sDescr)
117             rs1!PITime = .PITime
118             rs1.Update
119             Clear oResult
```

```
120         End If
121     End With
122
123 End Function
124
125 Public Function ValidateTime(sTime As String)
126
127     Dim oRes As clsResults
128     Dim i    As Integer
129
130     For i = 1 To oResCol.Count
131         Set oRes = oResCol.Item(i)
132         With oRes
133             If .Name = "C4_A1" Then
134                 Debug.Print
135             End If
136             If .Time1 <> "" Then
137                 If DateDiff("s", .PITime, sTime) > 20 Then
138                     rs1.AddNew
139                     rs1!ID = .Index
140                     rs1!Activity = .Name
141                     rs1!Descr = "TIME OUT"
142                     rs1!Time1 = .Time1
143                     rs1!Time2 = Format(DateAdd("s", 30, .Time1), "hh:mm:ss")
144                     rs1!PITime = .PITime
145                     rs1.Update
146                     Clear oRes
147                 End If
148             End If
149             If .Time2 <> "" Then
150                 If DateDiff("s", IIf(IsDate(.PITime), .PITime, "00:00:00"),
sTime) >
        5 Then
151                     Clear oRes
152                 End If
153             End If
154         End With
155     Next i
156
157 End Function
158
159 Public Function Clear(oRes As clsResults)
160
161     With oRes
162         .Name = ""
163         .Time1 = ""
164         .Time2 = ""
165         .Descr = ""
166         .PITime = ""
167         .Index = 0
168     End With
169
170 End Function
```

Properties

Date Created:	1/17/98 12:06:33 AM	Last Updated:	1/17/98 6:01:06 PM
Owner	admin		

Code

```
1 Attribute VB_Name = "ResultsCol"
2 Attribute VB_Creatable = True
```

```
 3 Attribute VB_PredeclaredId = True
 4 Attribute VB_Exposed = False
 5 Option Compare Database
 6 Option Explicit
 7
 8 Private mCol As New Collection
 9 Public Function Clear()
10     Do Until mCol.Count = 0
11         mCol.Remove 1
12     Loop
13 End Function
14 Public Function Count() As Integer
15     Count = mCol.Count
16 End Function
17
18 Public Property Get Item(vntIndexKey As Variant) As clsResults
19     Set Item = mCol(vntIndexKey)
20 End Property
21
22 Public Function AddActivity(sActivity As String) As clsResults
23 On Error GoTo Err_Handler
24
25     Dim oResult As New clsResults
26
27     Set AddActivity = mCol(sActivity)
28
29 Exit_Handler:
30     Exit Function
31
32 Err_Handler:
33     mCol.Add oResult, sActivity
34     Set AddActivity = mCol(sActivity)
35 End Function
```